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Oct. 1960

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Articles and Features
PAGE 5

John P. Laboon, recently retired as Executive Director and Chief Engineer of the Allegheny County Sanitary Authority, directed its program of study, design and construction. More data on page 18.

PUBLIC HEALTH BEGINS AT CITY HALL

Biggest, Best Sewer System *is only as good as the* House Connection

Unless house connections are as good as the main, infiltration can defeat the purpose of the newest, tightest, best engineered sewer system . . . Treatment plants pump huge amounts of ground water, capacity is taxed. Wedge-Lock* Clay Pipe helps cities beat this problem . . . Makes house connections *as good as* the main. Four through six-inch diameter Wedge-Lock gives triple protection against infiltration, exfiltration, roots, helps insure lines as good as the main. Wedge-Lock . . . safe enough to use *under* basement floors. Conforms to ASTM Specifications C 425-58T, Type 1. Put it in *your* plumbing code.

* Pat. T.M. Reg. U.S. Off.

WLC-580-6

Wedge-Lock CLAY PIPE

THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Write to any of these manufacturers for literature or a Wedge-Lock demonstration

Cannelton Sewer Pipe Company	Cannelton, Ind.	The Logan Clay Products Company	Logan, Ohio
The Clay City Pipe Company	Uhrichsville, Ohio	The Owensboro Sewer Pipe Company	Owensboro, Ky.
Graff-Kittanning Clay Products	Worthington, Pa.	Pomona Terra-Cotta Company	Greensboro, N. C.
Larson Clay Pipe Company	Detroit, Mich.	The Robinson Clay Product Company	Akron, Ohio
Lehigh Sewer Pipe & Tile Company	Fort Dodge, Ia.	Superior Clay Corporation	Uhrichsville, Ohio

"from Chicago"

Now Available ...SMALLER...MORE COMPACT

RATED AERATION SS

PACKAGED SEWAGE TREATMENT • Hydroshear Aerating Tank*

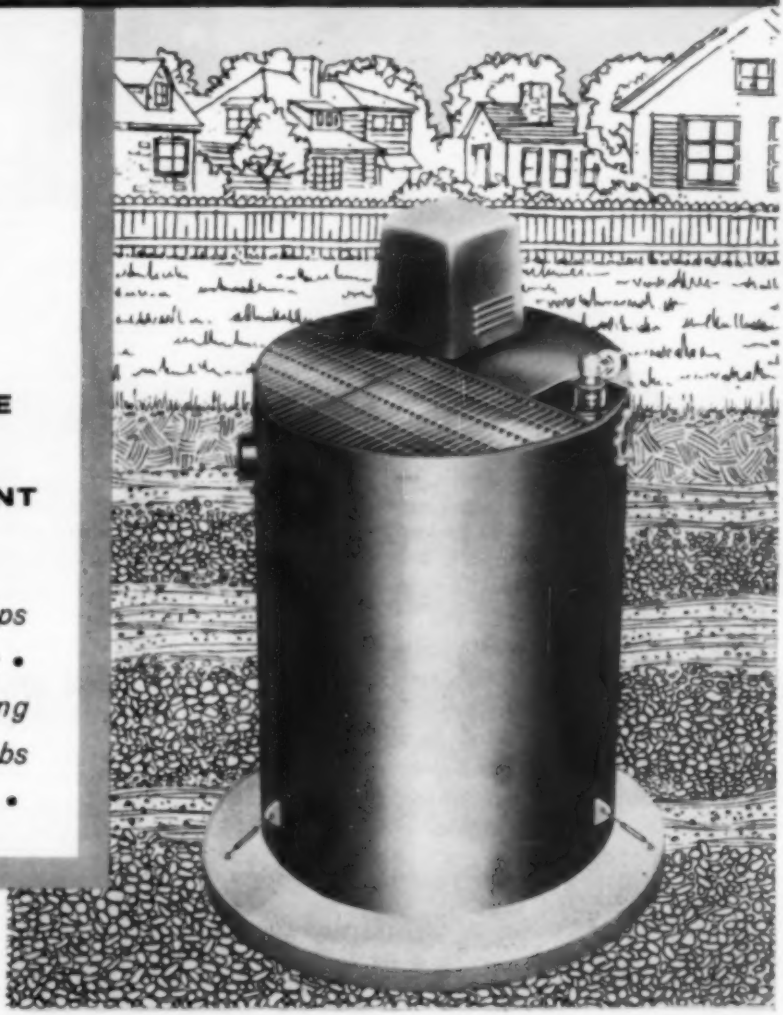
Solving Sewage Problems for 10-500 People 1,000-3,000-5,000 gallons per day

•

ODOR FREE
NUISANCE FREE
LOW COST
HIGH TREATMENT

for

Home Groups • Camps • Service Stations • Factories • Shopping Areas • Country Clubs • Motels • Resorts •



*Patent applied for

Proved Performance

OVER 650 RATED AERATION INSTALLATIONS

Proved Acceptability

See Your Chicago Pump Distributor

Ask for Bulletin 136

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION
CHICAGO PUMP
622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

© 1960 Chicago Pump

Report on snow removal from Irving Township, Illinois:

"You can't beat Caterpillar for year 'round dependability!"

Highway Commissioner Melvin Stokes says: "As far as we're concerned, Caterpillar builds the best motor graders on the market. Our old No. 212 worked for 15 years with practically no down time. It was worked hard on all kinds of jobs all year 'round. We've now jumped to this larger No. 12E. With all the improvements on it, we can take on any job of grading or snow removal with power to spare."

When Irving Township's 70 miles of roads are hit by snow, this new Cat No. 12E Motor Grader is ready to go. Its independent gasoline starting engine assures positive starts in any weather. Its snow plow built by Omaha Steel Works provides high-speed snow removal. And, no matter how tough the job, the dependability built into this grader keeps it working day after day with a minimum of down time.

That's the kind of performance you need year 'round in a machine. And that's what you can count on from Cat Motor Graders. You have your choice of four: the 115 HP No. 12E; the turbocharged 100 HP No. 112F; the 85 HP No. 112E; and the turbocharged 150 HP No. 14C. Bar none, each is the best investment for your tax dollars. The reasons: higher production, lower maintenance costs, greater availability and higher trade-in value. Get the full facts from your Caterpillar Dealer. Ask him to show you how Caterpillar can do the job and stretch tax dollars for your community!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A

944 WHEEL TRAXCAVATOR—another all-purpose Caterpillar machine for snow removal and road work!

Designed for action, safety, dependability and economy, this 2 yd. Cat wheel loader sets new standards of production for this type of machine. Your choice of two other models—the 2¾ yd. 966 and 1¼ yd. 922. Each features finger-tip shifting . . . automatic bucket positioner . . . outstanding operator comfort and safety. Directly interchangeable with the standard bucket, the exclusive side dump bucket eliminates turning and requires less loading space . . . increases versatility of the Cat wheel loaders! for snow removal and road work.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

BEST BUY FOR YOUR TAX DOLLARS

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATE

OCTOBER, 1960 • Volume 91, Number 10

Water District Has Three Sources of Supply . . . But One Is Awfull 89
With two good but limited sources, this District must treat a highly polluted surface water to meet growing demands. GENE A. CLAUSSEN

Winter Maintenance Requires Year-Around Planning .. 93
Organization, equipment readiness and materials stockpiles are key factors in effective snow and ice control. R. R. BARTELSMEYER

Giant Pipe Replaces Bridge 95
How an 18-ft. diameter culvert structure was installed by county crews to avoid a costly bridge replacement. F. R. LEMCKE

Steps in Solving Our Problems of Pollution Control 97
To assure the continued adequacy of limited available water resources, pollution control is of vital importance. This article summarizes progress in research, financing and law enforcement, accomplished with Federal, State and industrial resources.

Development and Design Features of the Pittsburgh Sewerage Project 106
Completion of a giant interceptor and sewage treatment plant to serve 71 communities culminated 14 years of planning. Here is the story of the project, told by the man largely responsible for its accomplishment. JOHN F. LABOON

More Water for the Keys 115
New aqueduct line will nearly triple water supplied to the Florida Keys.

Effective Contract Relations With Consultants 117
A discussion of comprehensive and definitive forms of agreement. ROBERT W. MEYER

Making a Traffic Sign Inventory 118
Are your signs in good shape? Are they standardized? Do you have enough? This sign survey gives the answers. GARY M. CHAMBERLAIN

Automatic Control of Residual Chlorine 120
The applications, mechanics and advantages of automatic residual chlorine control. A. E. GRIFFIN

Latex Mortars Show Promise in Pavement Repairs 123
Procedures for use of latex mortars in patching and results of recent experimental field applications.

Modified Altitude Valve Controls Distribution Reservoir 127
Unique but effective change compensates for low operating pressure on a butterfly altitude valve. D. C. CALDERWOOD

A Study of Refuse Collection and Disposal Service 128
How a small community analyzed their requirements and prepared a careful estimate of costs and revenue. MELVIN H. DIVEN

The Slump Test 168
Pictorial "how-to-do-it" shows test procedure.

Metropolitan and Suburban Water Problems 168

Methods of Compacting Utility Trenches 178

Three Methods for Decontaminating Water 180

Electronic Computers Tackle Toll Tabulation 200
Worth of computers for processing punch card toll records is demonstrated by experience of the New Jersey Turnpike. N. R. ASHCROFT

Better Maintenance for Waste Heat Boilers at Incinerator 207
Cost of new soot blowers will be repaid in three years. FREDERICK W. TRAUTWEIN

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Public Works T. M. Reg. U.S. Pat. Off.

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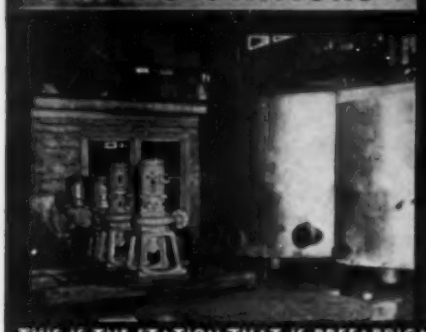
200 So. Broad St., Ridgewood, N. J.

ZF PREFABRICATED PUMPING STATIONS



THIS IS THE STATION THAT IS PREFABRICATED

AND DELIVERED

TO JOB SITE

READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

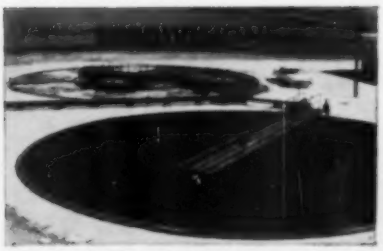
ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZF ZIMMER & FRANCESCON P.O. BOX 359, MOLINE, ILLINOIS

WALKER PROCESS SPARJAIR COMPLETE SEWAGE TREATMENT PLANTS

Designs for all Developments and Land Planning Projects



Hampton Pk. (Hsg. Devel.), Ill.—1 mgd tot. cap.

Finn Trailer Ct., Ill. (365 units)—45,500 gpd.

Hillcrest Shpg. Ctr., Joliet, Ill.—50,000 gpd.

Sparjair units overcome previous objections to locating a plant near residences, shopping areas, schools, etc. Its new but proven principle of Contact Stabilization aerates and thoroughly oxidizes all odor producing wastes.

Nested design provides complete treatment equal to large municipal plants.

1. Permits development of outlying, low cost land.
2. Capacities from 50 to 5000 population equivalent.
3. Eliminates septic tanks and drain fields.
4. Virtually automatic—Simple operation.
5. Approved by Health Authorities.
6. Odor free — no septic or stale operations.

Details and layouts are available to Consulting Engineers and their Architects, concerned with the design of package sewage and water treatment plants. Write factory at P. O. Box 286, Aurora, Ill. for complete information.

Walker Process also offers CLARIPURE Package Water Purification Plants—pre-designed capacities from 50 to 600 gpm.

WALKER PROCESS EQUIPMENT INC. FACTORY • ENGINEERING OFFICES LABORATORIES AURORA, ILLINOIS

POINT OF VIEW

Good Materials and Equipment Were Never More Important

THE HIGH cost of labor is only one of the factors that emphasizes the need for using the best available materials and equipment. Clay sewer pipe provides a good illustration. In the 8 and 10-inch sizes, the cost of the pipe itself represents less than 15 percent of the average cost of a job: On a $100,000 job, a poorer quality of pipe selling for 10 percent less could "save" initially as much as $1,000 or possibly $1,500. One or two repair jobs due to pipe failure could more than eat up this mythical saving; and, in addition could create problems of traffic interference because every sewer failure requires digging a hole to remedy the failure and that hole is usually in a busy street.

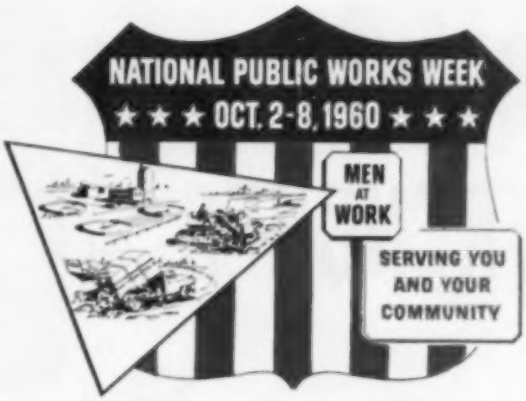
It doesn't pay to buy cheap equipment or materials, even such an everyday material as clay pipe. The "saving" is usually infinitesimal initially, and that's all it is—initial. The real cost comes later.

The Effect of Disease on Military Operations

A RECENT volume on preventive medicine in World War II points out that deaths from disease constituted only 5.1 percent of the total deaths, both in and out of combat, in the Army, but disease was responsible for 85.2 percent of the admissions to Army medical installations. There are two facts of interest here. One is the uniformly high grade of medical care provided by the Army. The other is the lack of knowledge, on the part of so many line commanders, of what the disease hazards were and how preventive medicine skills could eliminate or minimize them. Engineers are particularly important—and skilled—in broad fields of disease prevention; but they ought to be better in organizing some fanfare to educate laymen, both civil and military, on what can be done if given the chance.

A National Public Works Week

THE BETTER a public works job is done the less news value it has. That is one reason why our public works men get so little of the credit due them. Taxpayers are rarely conscious or appreciative of the skilled day-by-day performance of the multitudinous tasks required to keep public facilities running smoothly. These jobs are not dramatic; nor are they readily publicized.



The American Public Works Association has taken a long-needed step toward education, understanding and popular support for the men who perform the duties so essential to the daily life and welfare of our people. "National Public Works Week" can readily be the first item in a program to acquaint the public with the values they receive from their public works expenditures. It is going to be difficult to dramatize these municipal housekeeping jobs; and the National Public Works Week must be followed by a continuing program of education for it is only a first, though a much-needed, step. We congratulate the APWA for recognizing a long-neglected need and in providing leadership for meeting it.

Are The Russians Ahead on Stream Pollution Control?

ACCORDING to some people, Russia has better technical schools, graduates more technical personnel and leads us in many research phases. In fact, some commentators would have us comparatively in a bad way. We would like to know, in the light of all these technical and industrial achievements, what the Soviets are doing in stream pollution control. Are rivers models of cleanliness and, if so, what methods are used to treat wastes? We assume Russian rivers can carry no greater pollution loads than our own rivers but perhaps Russian research has multiplied this ability; or maybe no one cares. Anyway, a reliable report might be interesting.

PIPE THAT DOESN'T GET COLD FEET IN WET TRENCHES

This cast iron pipe was installed to carry water to an important industrial site in Indiana.

At the time of installation, weather conditions were severe; the trenches were wet and muddy.

Still, the cast iron pipe was easily and speedily assembled, enabling the contractor to complete the job well ahead of the deadline.

Cast iron pipe does not get cold feet over rugged soil conditions. Its rugged design, corrosion-resistant qualities, and bottle-tight joints will withstand the most severe conditions.

Modern, cement-lined cast iron pipe will deliver a continued full flow of water for at least a century . . . and rarely requires repairs or replacement.

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

CAST IRON PIPE
THE MARK OF THE 100-YEAR PIPE

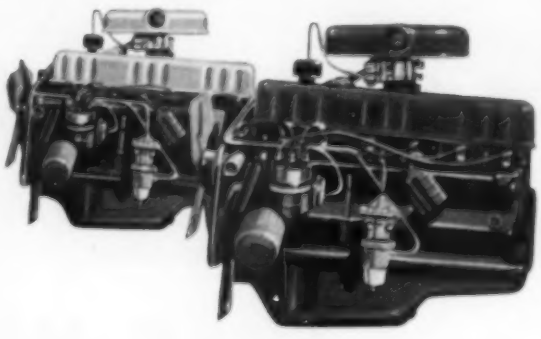
ANNOUNCING THE 1961 FORD FALCON PICKUP

LOW IN PRICE - AMERICA'S LOWEST-PRICED COMPACT PICKUP!

What a Falcon saves you on price* could keep your gas tank filled for thousands of miles! And there's more savings to come! Main underbody members are Zinclad-protected against rust and corrosion. Front fenders bolt on for ease of replacement—cost just $29.95 each. Insurance is as much as 15% less. Aluminized muffler lasts up to three times as long as ordinary types. You save on tires, on brakes, on oil . . . you name it and your Falcon saves it!

*Based on latest available manufacturers' suggested retail delivered prices

ECONOMY NEVER HAD SUCH STYLE



LOW GAS COSTS–OVER 30 MILES PER GALLON IN CERTIFIED TESTS!

In certified tests by the country's foremost independent automotive experts, the Falcon Pickup with 144-cu. in. Six scored as high as 38.3 miles per gallon! Average of all tests combined—hills and traffic, as well as moderate speeds on the level—was 30.5 mpg! Low oil costs, too—change it only every 4000 miles!

- *Roomy comfort for 3 husky passengers!*
- *Rides, handles like a passenger car!*
- *High Falcon fashion inside as well as out!*
- *Optional Fordomatic Drive available!*

1961 Falcon Ranchero, shown here in Montecarlo Red, is available in 8 handsome colors with Color-Keyed Luxury interiors.

NEW HIGH-PERFORMANCE OPTIONAL SIX!

For '61 Ford's new Falcon Ranchero offers a choice of two modern gas-saving engines—144 Economy Six and, as an option, a new high-performance 170 Six. Both available with standard or Fordomatic transmissions. And thanks to the simplicity of their proven design, servicing is fast, low in cost!

See your Ford Dealer's Certified Economy Book . . . it proves

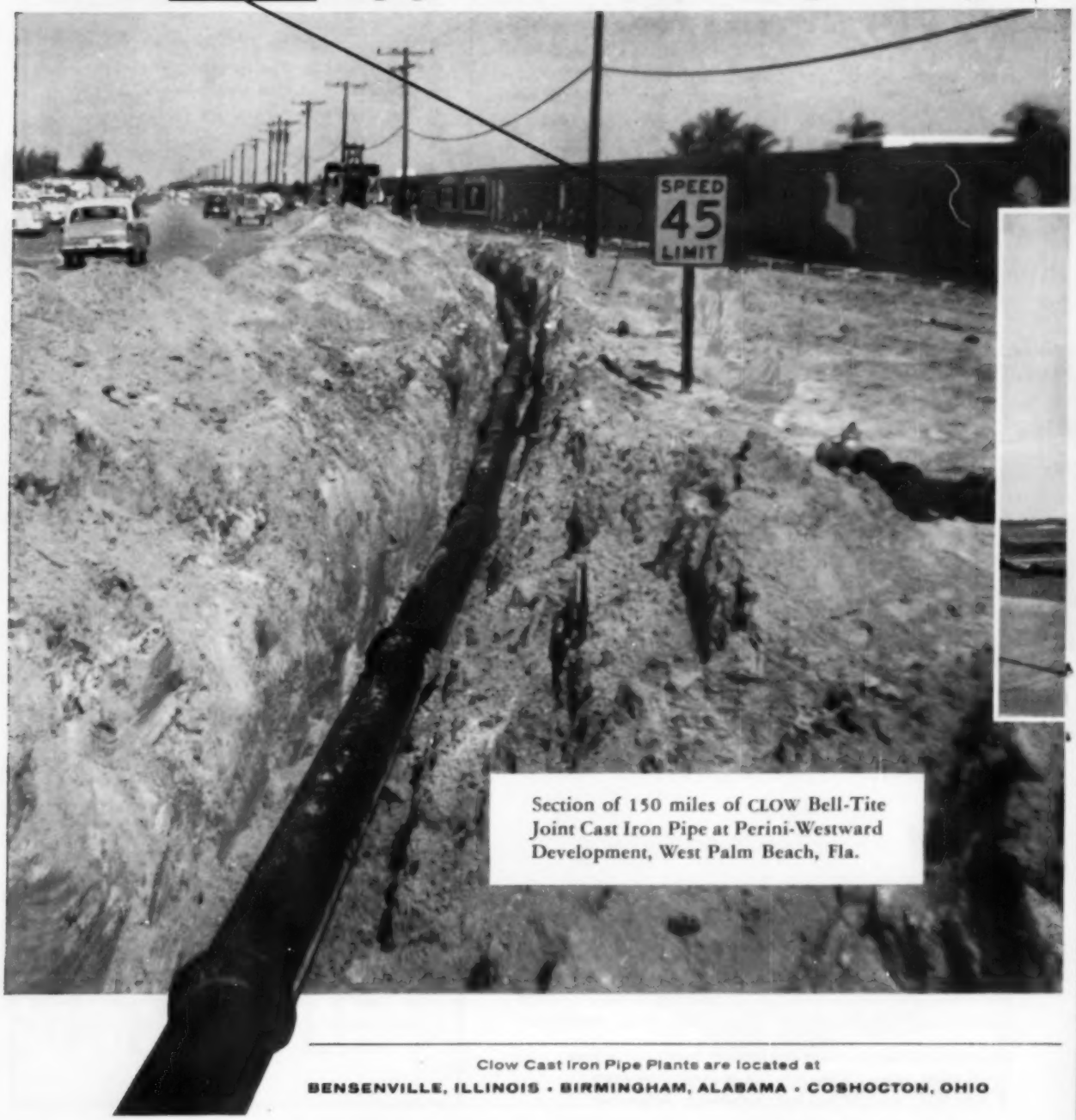
FORD TRUCKS COST LESS

LOW LOADING HEIGHT

Cargo floor to the ground measures a scant 25.2 inches . . . that means easy loading. And what a load! The Falcon Ranchero has a full 800-lb. load capacity! In its big six-foot box—over 7½ feet with tailgate flat—there's room to spare for just about any pickup job! You can open or close the tailgate with one hand . . . it locks tight and rattle-free automatically!

CLOW

This SIGN applies to the highway



Section of 150 miles of CLOW Bell-Tite Joint Cast Iron Pipe at Perini-Westward Development, West Palm Beach, Fla.

Clow Cast Iron Pipe Plants are located at

BENSENVILLE, ILLINOIS · BIRMINGHAM, ALABAMA · COSHOCTON, OHIO

CAST IRON

PIPE

There is no limit to how fast you can lay

CLOW Bell-Tite® JOINT CAST IRON PIPE

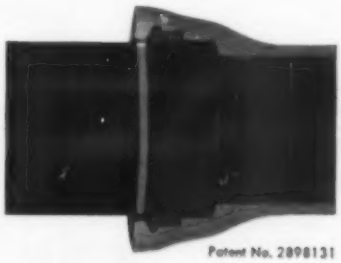
You can install CLOW Bell-Tite Joint Cast Iron Pipe as fast as you can dig a shallow trench. Photo shows the back hoe which clawed open the trench lowering a length of Clow pipe into it.

Over 150 miles of Clow Bell-Tite Joint pipe are the life lines of the water and sewage facilities for this Perini-Westward Development at West Palm Beach, Fla. Time-saving installation plus the economy of material—no accessory but a single molded rubber gasket—are important factors in this $4,000,000 waterworks project installation. One of the owners of this "City within a City" is Louis R. Perini, chairman of the board of the Milwaukee Braves and president of the Perini corporation.

CLOW Bell-Tite Joint Cast Iron Pipe can speed your installations, too. Let us tell you about its many advantages.

Clow Bell-Tite Joint Pipe saves time and money

Assembly is easy and rapid. Just wipe the joint clean, lubricate and push spigot into the bell. When yellow stripe is no longer visible, joint is bottle tight. A single rubber gasket is the only accessory. There are no bolts, no nuts, no followers, no couplings, no extras.



Patent No. 2898131

CLOW CAST IRON PIPE

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:
Eddy Valve Company, Waterford, N.Y.
Iowa Valve Company, Oskaloosa, Iowa

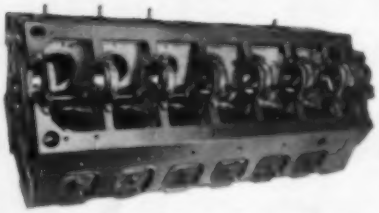
ROILINE GAS ENGINES

are advanced, dependable, and proven in Municipal Service.

In-line 6, V-8, or V-12 cyls.—up to 706 hp.

HEAVY DUTY... LONG LIFE

A look inside these engines reveals the rugged construction that can be relied upon for dependable service.

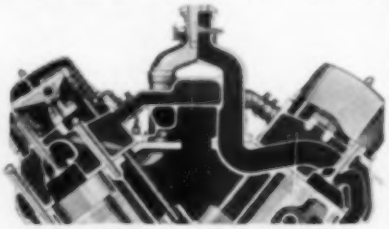


Internally ribbed crankcase gives solid crankshaft support. Extra rear main bearing absorbs side thrust.

Large diameter, short in length, the rugged counterbalanced crankshaft handles power without vibration. It has generous bearing areas.

MORE POWER... BETTER ECONOMY

These ROILINE engines are the most modern, most powerful natural gas-butane-gasoline engines in their class.

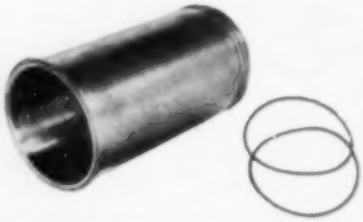


The "Easy Flow" manifold design provides perfect fuel and air distribution to all cylinders through large individual intake ports.

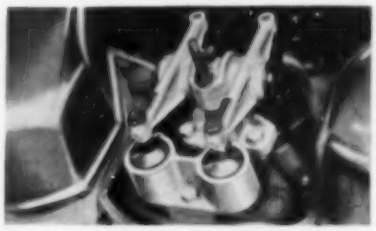
Aluminum pistons are taper cam ground. Full floating piston pins. Connecting rods have big wear-resisting replaceable bearings.

EASY MAINTENANCE... QUICKLY SERVICED

All wearing parts have replaceable bearing surfaces. *All* routine maintenance points are readily accessible.



Long wearing cylinder sleeves are easily replaced and cost far less than reboring cylinder block and installing oversize parts.

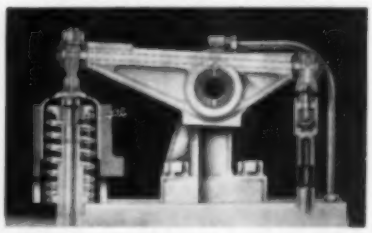


Cylinder heads can be removed by one man without disturbing manifold, carburetor, or controls. Note guided valve mechanism.

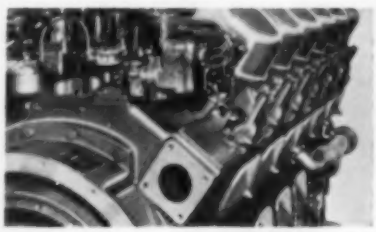
SMOOTH—QUIET... CLEAN—COOL

Benefits from newest design features mean more comfortable operating conditions and easier maintenance.

499 *Write for literature*



Hydraulic "Zero-Lash" lifters eliminate noise and adjustments and extend valve life. Engines are practically vibration-free.



Exhaust manifold is water cooled and integrally cast into the crankcase to provide cooler operating area and fast warm-up of the engine.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Los Angeles**

Factories: Waukesha, Wisconsin and Clinton, Iowa

ELECTRO-MATIC®..."the first name in Traffic Control"

Thirty-Three Years of Leadership

TRAFFIC ACTUATED®

First to perceive the need....
first to conceive the way

In 1927 Automatic Signal developed the *first* traffic-actuated signal. Since that day, creative thinking, imaginative engineering and manufacturing skill have built a reputation for foresight and achievement. Automatic Signal will continue to serve the future by seeking new needs, by developing new ways of helping tomorrow's traffic move . . . adding to its long list of such firsts as:

- Pressure Detector
- Semi-Actuated Controller
- Full-Actuated Controller
- Multi-Phase Controller
- Magnetic Detector
- Volume-Density Controller
- Pedestrian Controller
- Pedestrian Pushbutton
- Cycle Selector
- Speed Controller
- Advance Green Timer
- Lagging Green Timer
- Pedestrian Interval Timer
- Volume Computer
- PR System
- Radar Detector
- Minor Movement Controller
- Radar Speed Meter
- Railroad Radar
- Speed Computer
- Traffic Monitor
- Density Computer
- All-Red Clearance Timer
- Phase Overlap Unit
- Plug-In Controllers and Accessories

ELECTRO-MATIC CONTROL

AUTOMATIC SIGNAL DIVISION EASTERN INDUSTRIES, INC.
NORWALK, CONNECTICUT

What does **Performability** *mean to your fleet operation?*

Your own fleet operation will show real savings and run far smoother with the '61 Lark. Already fleet proven in wide use, The Lark with new improvements and advances has Performability – and here's how you benefit:

Even greater Economy! The all-new Skybolt Six engine, of valve-in-head design and 112 HP, has already shown 17% greater gasoline mileage than Larks used in more than 1000 fleets last year . . . pre-tested and proven in the field by the largest "blue chip" fleet operators!

Even greater Performance! Acceleration your drivers want—10% better at low speeds, 18% better at middle speeds, 35% better at high cruising speeds for safe passing.

Even greater Driver Comfort and Safety! A new recirculating ball steering system and new front suspension make steering 30% easier. Also new for '61—handsome safety-padded dash—increased legroom—smart low-silhouette body styling—increased visibility—oversize bonded brakes! And still those wonderful flat floors, high headroom, big seats, matchless roadability.

Even greater Maintenance Savings! Fleet records already show The Lark saves ⅓ on maintenance, compared to other cars. But this year new brakes, new larger clutch (for the Skybolt Six) and several servicing improvements (such as a counterbalanced hood) will save you even more.

The Sum Total of 2000 engineering and design improvements, perfected and coordinated, give the '61 Lark unique response, economy, durability. That's '61 Lark PERFORMABILITY. You have to drive it to believe it!

NO CLAIMS, NO GUESSES—THESE ARE THE FACTS

Actual field tests by commercial and government fleets show uniform satisfaction—"Excellent acceleration from standing start, good passing performance"..."Good hill climbing"..."Excellent maneuverability and directional stability"..."Exceptionally good (steering) response and light touch"..."Good clutch and brake action"..."Better roadability than any car I have ever used."
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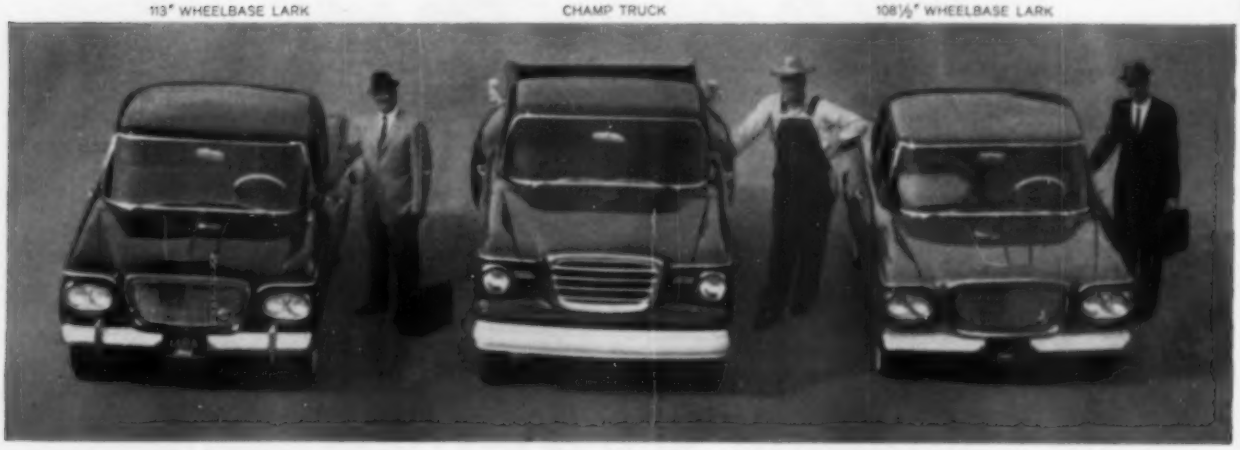
113" WHEELBASE LARK — CHAMP TRUCK — 108½" WHEELBASE LARK



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PW-10-60-F1

NEW FOX spreader feature

A Fox Exclusive—continuous power from transmission to spinner drive. Permits even feeding and spreading of materials at variable truck speeds.

How to make a ton of salt go 6 times as far

Ever totaled up your winter salt and aggregate bills and wondered if there was some way to cut them—and still keep icy pavements under control? But the old bugaboo—uneven spreading in heavy traffic had you licked.

SEE YOUR DISTRIBUTOR

Now you *can* do something about it—with a Fox Mountable Spreader. For Fox has developed a new transmission that provides continuous power takeoff—*from transmission to spinner drive*—so that, regardless of the speed your truck is traveling, the rate of feed and the width of spread will always be the same.

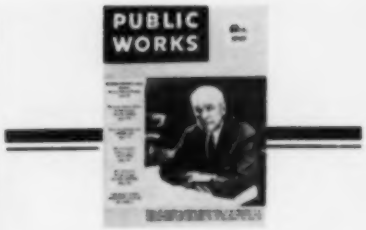
And, too, with this new Fox transmission you can get a spread of from 8 up to 60 feet with wet sand and cinders—and up to 90 feet with salt—if you need it.

So, instead of 6 yards of salt covering approximately 10 miles, it can be made to effectively cover 60 miles. That's a real saving, isn't it?

Remember, also, this is a one-man operation—controlled from inside the cab. Ask your nearest Fox dealer for details or, better yet, ask him to demonstrate.

FOX RIVER TRACTOR CO. ROAD MACHINERY DIVISION

Dept. R3, 1020 N. Rankin St. • Appleton, Wisconsin • Phone: REgent 4-1451

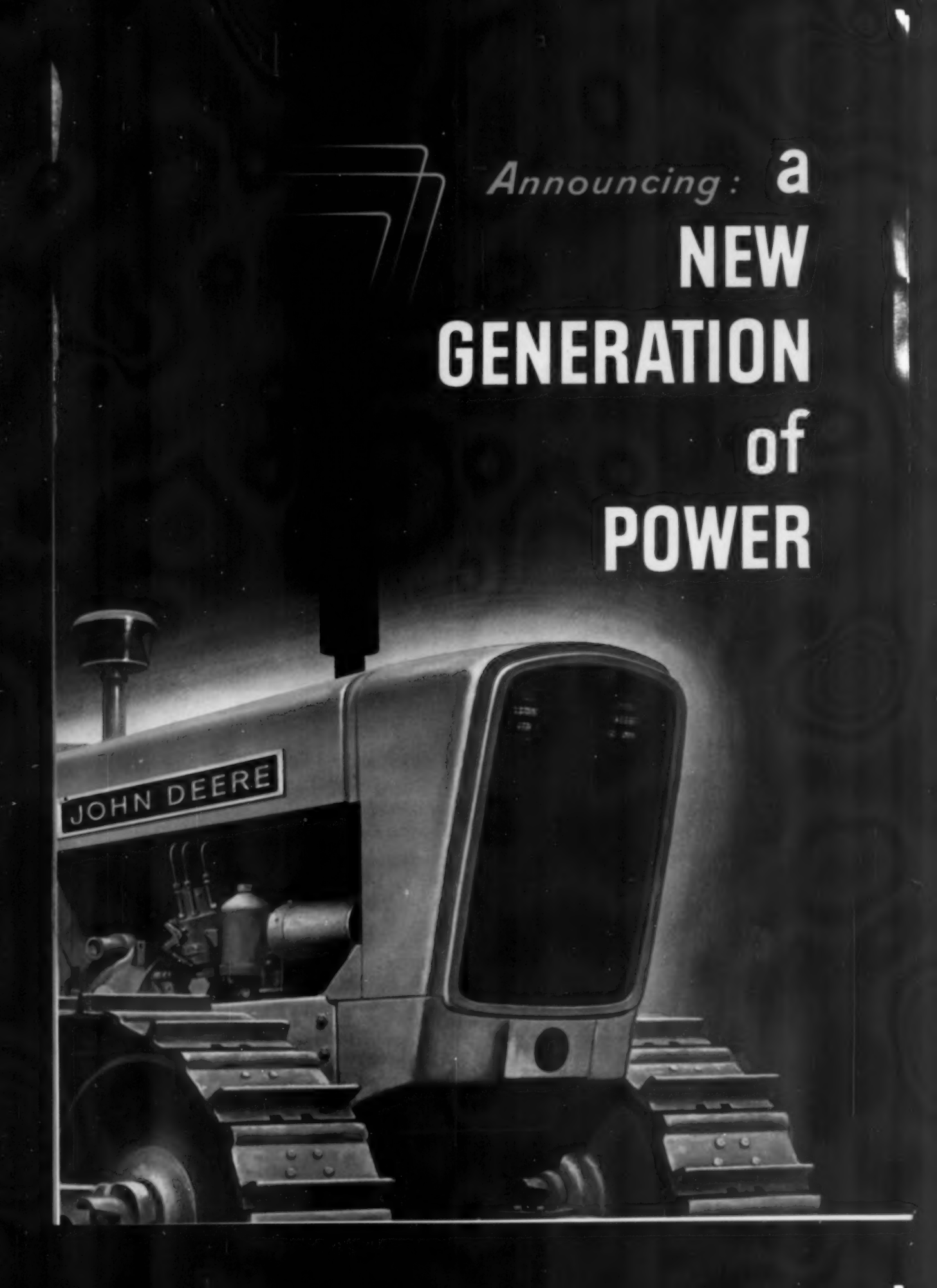


John F. Laboon, recently retired as Executive Director and Chief Engineer of the Allegheny County Sanitary Authority, has had an extraordinary career in engineering; and the manner in which he has performed his duties have brought him many honors and worldwide recognition.

After graduation from Carnegie Institute of Technology in 1912, he did two years of graduate work, receiving a BS degree in 1914 and CE in 1919. He is a member of Tau Beta Pi.

Starting work in 1912 with the consulting engineering firm of Chester & Fleming, he became chief engineer of the Pittsburgh Filter Mfg. Co. in 1915; and in 1918 he became a partner in The Chester Engineers, an association that continued for 17 years. Then in 1936 he was appointed Director of the Department of Public Works of Allegheny County and Chairman of the Allegheny County Authority. He was on leave of absence from Jan., 1943, to Dec., 1945, for wartime services as Lt. Col. and Colonel on military government duties in Sicily, Italy and Sardinia, returning to Allegheny County upon release from the service. From 1946 to 1955, he was engaged in consulting engineering, meanwhile acting as chief engineer of the Allegheny County Sanitary Authority. Since March, 1955, he has been Executive Director and Chief Engineer of the Authority—a connection terminated by his retirement Aug. 31, though he is retained as a consultant.

In addition to recognition as Engineer of the Year by the Pittsburgh section ASCE, and honorable mention by ASCE for the second greatest engineering project last spring, he was decorated by Pope Pius XII and also by the Italian government and by Italians in America, though he is not, of course, an Italian. His hobbies are golf, other forms of athletics and bridge. He and Mrs. Laboon have nine children, two of whom are priests and three are Sisters of Mercy; and fourteen grandchildren.


Announcing: a
NEW
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of
POWER
JOHN DEERE

a NEW GENERATION

1010 · 2010 · 3010 · 4010 Tractors

New tractors and attachments! New ideas in design and manufacture! Six completely new tractors, ranging in size from 40 to 85 engine horsepower will be offered with the Ten-Ten series first off the line. New tractor loaders, bulldozers, backhoes, and a variety of other equipment give the fleet owner and single-unit operator more to work with . . . more to profit by.

John Deere engineers threw away the book to bring you these new power units. Years of research, development, and testing have combined the best proved engineering principles with some of the freshest ideas in the industry today. The New Generation of Power is here!

High Productivity

More usable horsepower in each tractor size—that's the advantage earthmoving contractors, pit operators, landscapers, and construction men will find in Deere power. More usable horsepower means more work per dollar invested. Coupled with fresh engineering approaches on operator efficiency, comfort and convenience, you'll speed production on a wider range of jobs.

Balanced Performance

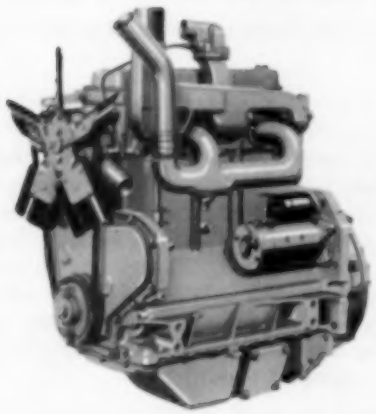
John Deere power—usable power—is day-in, day-out performance. Tractors, engines, transmissions are quality-made for full-day productivity, day after day, on job after job. Their hydraulic systems are pressure-stressed to handle continuous maximum loads without fatigue. In every respect, you can count on cost-cutting performance in this New Generation of Leaders.

# of LEADERS

JOHN DEERE

New power for profit

with John Deere's wide-range power concept



Gasoline or Diesel • 4 or 6 cylinders

Completely new tractor engines, Deere designed and built, provide a new kind of performance—wide-range power—for every construction use. True variable-speed engines offer flexible, efficient power throughout the full throttle range. Coupled with transmissions providing a wide range of application-matched speeds, these new 4- and 6-cylinder engines put the new John Deere power train far ahead in horsepower efficiency, lugging ability and balanced performance.

There is big news in hydraulic power, too. Pump designs include an advanced type new to the earthmoving industry. Plenty of pump capacity, plenty of smooth, responsive hydraulic power insures efficient operation on every job.

Choose from 2 new Crawler Loaders or

For any application *. . . Excavating, loading, material handling—name your job, and you'll find the right unit for it in the all-new John Deere loader line. You'll gain new operator efficiency, too, with improvements such as one-lever boom and bucket control.*

Powered right for high performance, the John Deere Ten-Ten Crawler-Loader meets all modern demands for a versatile, efficient unit in the 40 engine h.p. class. Sixty-six inch bucket has a rollback of 40 degrees, 8500 pounds breakout force, a full-height lifting capacity of 3500 pounds, and a dumping clearance of 8 feet, 1 inch. The Ten-Ten Crawler-Loader has a 3/4-yard bucket with 8 nodular iron teeth and is available with gasoline or Diesel power.

With extra capacity for top production, the all-new Twenty-Ten Crawler-Loader combines the 50-h.p. John Deere gasoline engine with a one-yard bucket. Fast cycle time is assured by the 40-degree rollback of the 66-inch bucket, 8500 pounds breakout, 3500-pound full-height lifting capacity and a 7-foot, 11-inch dumping clearance. Eight nodular iron bucket teeth speed excavating work in rock, frozen ground or other difficult operating conditions.

4 Wheel Loaders for greater job profits

A wide range of power matched bucket sizes, each with plenty of dumping height and pry-out power assures you the kind of loading performance you need. Whether your job calls for tracks or wheels, choose John Deere for new power and high productivity.

Valuable on any job, the compact 701 Loader for John Deere Ten-Ten Wheel Tractors has a standard 3/8-yard bucket, four feet in width, with a 20-degree rollback providing 4800 pounds of breakout force, 2000 pounds full-height lift capacity, and a dump clearance of 102 inches.

Low-cost loading is yours with the economy priced 700 Loader which mounts on either Twenty-Ten or Thirty-Ten Wheel Tractors. Bucket size is 5/8 yard. Breakout force is 4800 pounds, full-height lift 2000 pounds and maximum dumping clearance, 102 inches.

Single-lever control on the 720 Loader for Twenty-Ten and Thirty-Ten Wheel Tractors speeds operation. The 720 Loader has 6650 pounds pryout pressure, 3500 pounds full-height lift effort, and clears 99-1/2 inches for dumping. Buckets are 5/8 and 7/8 yard.

30-degree rollback gives the 740 Loader for the Forty-Ten Wheel Tractor 6650 pounds of pry-out. Bucket capacity is 7/8 yard and lift effort, 3500 pounds at full height. Dump clearance is 99-1/2 inches. The loader frame is designed to accommodate rear-mounted backhoes.

Increase trenching versatility

with a John Deere 50 or 51 Backhoe

Team the new power, handling ease and mobility of John Deere Tractors with the field-proved performance of either the 50 or 51 Backhoe! You'll take advantage of every benefit of John Deere's new advances in engine power and hydraulics, plus the greater trenching versatility these units provide. Ease of operation and quick adaptability to working conditions are your assurances of low-cost trenching for soil pipe, foundations and cable laying.

2-Lever Control. Efficient 2-lever control of boom, dipper stick, and bucket, a widely preferred feature on John Deere Backhoes during the past two years, is yours again with any backhoe combination in the line. Eliminates excess hand motion throughout a long working day; helps operator do fast, precision work.

5-Position Digging. The John Deere 51 Backhoe digs flush right or left against walls, fences or buildings. The rotary boom cylinder centers or slides to any of four off-center positions along the mounting, moved by the unit's own hydraulic power. One man with a wrench easily makes the switch in minutes right on the job.

Take your pick from 5 all-job crawler bulldozers

Need a blade for heavy pioneering, road building, or precision finish grading? John Deere has it! Five outside- or inside-mounted dozers, sized right and power matched for your needs, are included in the new line. All-hydraulic models with power tilt, angle, and cut are now operated by new single T-bar control. Operator moves control to the position he wants and the blade repeats the motion! Just one of many new ideas throughout the whole line!

For clean work at low cost, select the John Deere Ten-Ten Crawler with 610 inside-mounted Dozer. Available with 72-inch or 90-inch blade with three-piece cutting edges. Angles 18 and 25 degrees right or left, cuts to 12 inches below track level, and lifts as high as 40 inches.

Power plus flexibility is yours with the John Deere Ten-Ten Crawler and all-hydraulic 612 Dozer. Change tilt, angle or cut on the go with one control! Inside mounted, with 80-inch blade.

For big work savings, the 624 outside-mounted Dozer mounts on either the Ten-Ten or Twenty-Ten Crawler. Blade is 90 inches wide, 23 inches high with three piece cutting edge. Cuts as deep as 12 inches below track level, and is easily set to angle 25 degrees right or left. Lift is 48 inches.

Pair the extra power of the Twenty-Ten Crawler with new inside-mounted 620 or 622 Dozer. Choose from 72-, 80- or 90-inch blades with hydraulic lift or full hydraulic operation.

Dependable John Deere diesel power, teamed with a versatile elevating scraper, provides a widely preferred earthmoving combination for road and street work, land forming, and stripping overburden.

PARTS and SERVICE

Parts and service for any John Deere Tractor are always available from your nearby John Deere dealer. He and his service crew know how to service and maintain construction equipment with minimum downtime expense. Find out how this man can help you now. Check with the classified telephone directory or write John Deere, 3300 River Drive, Moline, Illinois.

JOHN DEERE CREDIT PLAN

All tractors and equipment can be purchased on terms of the John Deere Credit Plan. Arrangements are made in strict confidence by your dealer. Terms are tailored to individual requirements. Protective life insurance and property insurance are also available at low cost.

LEASING PLAN

Throughout the United States, three to five-year leasing arrangements can be made through your John Deere dealer. The plan is specifically designed to enable contractors and others to obtain profitable use of the most modern, efficient equipment, without affecting needed working capital.

JOHN DEERE Earthmoving Logging Landscaping and Material Handling Equipment

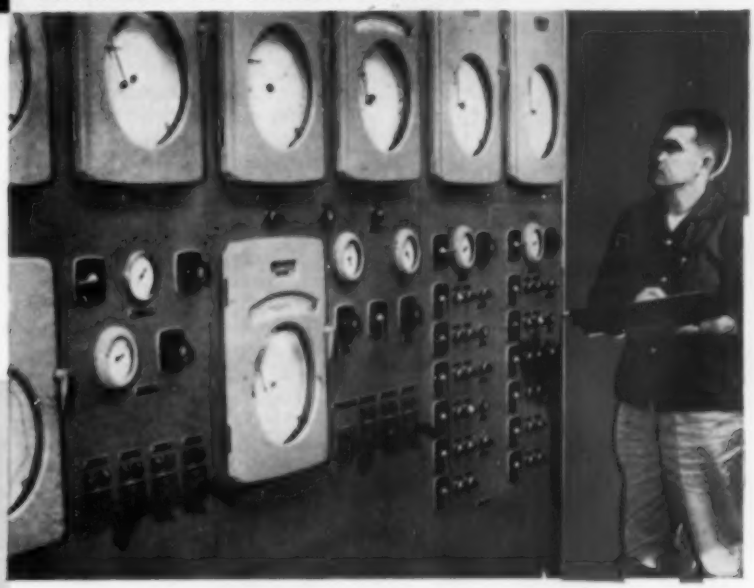
JOHN DEERE

POSITIVE CONTROL OF *MATERIALS IN MOTION* B-I-F METERS FEEDERS CONTROLS

B-I-F MAKES FILTER CONTROL AUTOMATIC . . . SIMPLE . . . ECONOMICAL!

B-I-F *Builders-Providence*

Auto-Central® Filter Control Systems Bring Push-Button Economies to Cost-Conscious Communities!



PROVEN DEPENDABILITY IN PUSH-BUTTON FILTER PLANTS

Installations at:

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Lexington, Kentucky
U. S. Steel, Fairless, Pa.
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Marshall, Texas
Greenwich, Conn.
Greensburg, Pa.
Washington, Pa.
E. St. Louis, Ill.
Tonawanda, N. Y.
Ft. Lauderdale, Fla.
Huntington, W. Va.
Ardmore, Okla.
Port Arthur, Texas
Joplin, Mo.

Put your filter plant under push-button control . . . save time, money and increase reliability. One operator, pushing one button, starts the automatic sequencing of all valves in the filter backwash cycle . . . starts a high speed recorder which eliminates need for log entries and computations. Result: reduced operating time, elimination of human error, manpower released for more important duties.

System also permits economical arrangement of physical plant, lowers initial cost . . . automatically assures precise control of backwash cycle, provides reliability never possible with manual systems.

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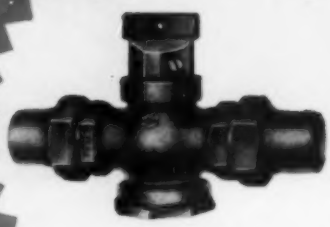
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one of a
complete line
of water
service
products
GENERAL PRODUCTS DIVISION
HAYS MFG. CO.
ERIE, PA.

COMMUNICABLE DISEASES IN WORLD WAR II

In this text, edited by the Historical Unit of the Army Medical Department, particular attention is given to the six internationally quarantinable diseases (cholera, plague, yellow fever, louse borne typhus fever, louse borne relapsing fever, and smallpox). Diseases of military importance encountered for the first time during World War II were schistosomiasis and filariasis. It is interesting to note that as the war continued the incidence of scabies climbed. Sand fly fever put in its appearance with its own special problems of control, and dengue, which had almost been forgotten, reached epidemic proportions in some Pacific theaters. Many other diseases are fully considered. 544 pages; $5.50. Office of The Surgeon General, Dept. of the Army, Washington 25, D. C.

YOU AND PUBLIC RELATIONS

Consulting engineers as individuals, firms and state groups will find guidance on sound public relations procedures in an information-packed booklet entitled "You and Public Relations," published by the Consulting Engineers Council. In the booklet public relations are defined as "the continuing process by which one endeavors to obtain the good will and understanding of his clients, his employees and the public at large." The many ways in which consulting engineers can achieve these objectives are presented in a concise and practical manner. The 16-page booklet is being distributed to consulting engineers by the Consulting Engineers Council, 322 Reisch Bldg., Springfield, Illinois.

USE OF THE MEMBRANE FILTER

Use of the membrane filter technique in the bacteriological analysis of water is explained with text and illustrations in "The Membrane Filter," a teaching aid intended to supplement a filmstrip released last year under the same title. Single copies of the booklet, PHS Publication 749, may be obtained without charge from the Division of Water Supply and Pollution Control, Public Health Service, U. S. Department of Health, Education and Welfare, Washington 25, D. C. Quantity purchases at 20 cents per copy may be made from the Superintendent of Documents, Government Printing Office.

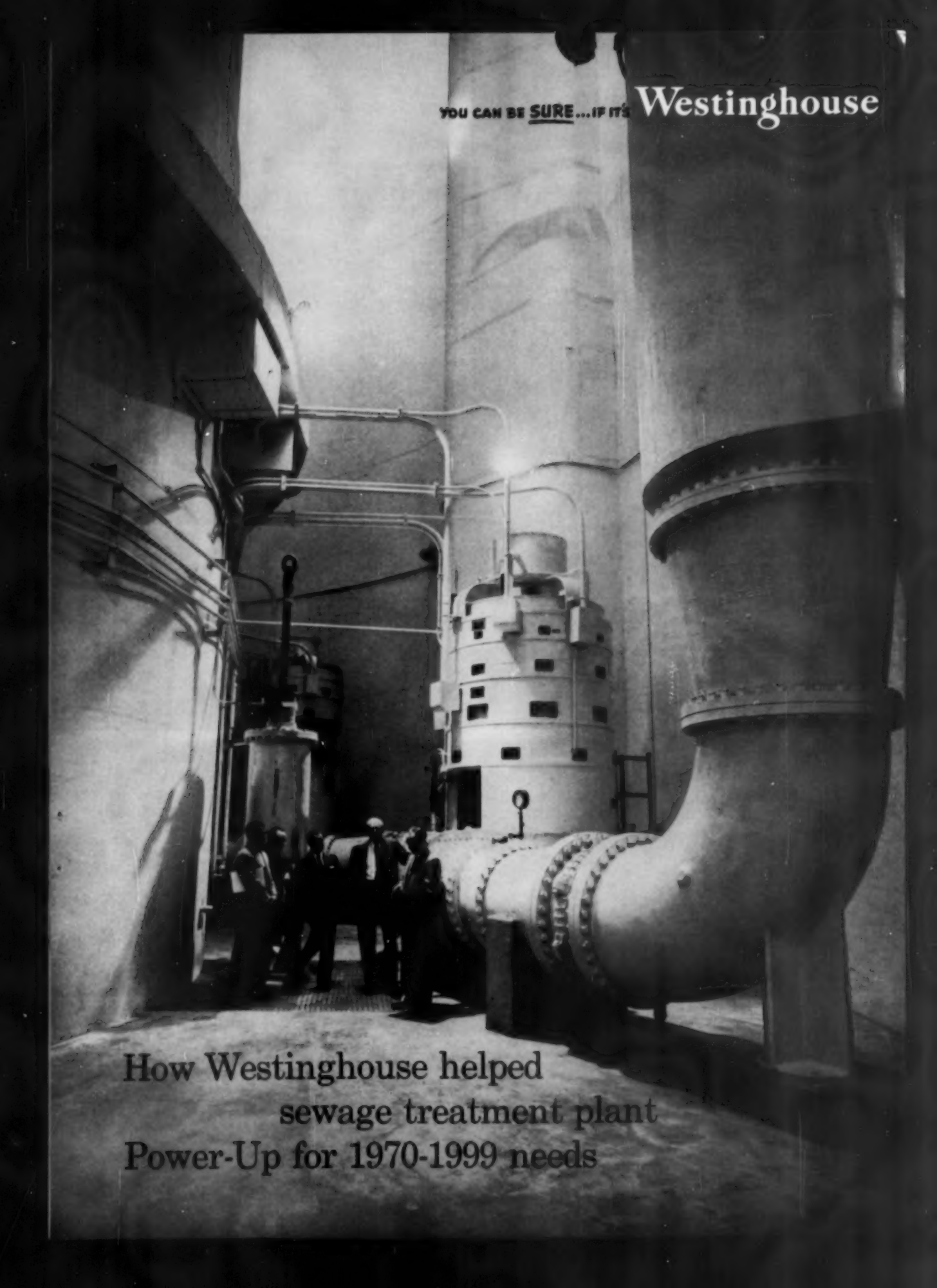
COLD INJURY GROUND TYPE

Somewhat over 91,000 American soldiers, excluding Air Force and Navy personnel, suffered cold injury during World War II. Most of this was foot damage; some of it was probably inherent in the conditions of warfare, but the great bulk of it could have been prevented. No satisfactory method of medical treatment is available so prevention is paramount. This book is a thoughtful and complete account of what happened to our soldiers, and what was done to mitigate the situation. Generally speaking, as was the case with many other causes of disability among troops, the problem was one of command responsibility and line commanders were not prepared. But cold injury is not a new problem, it was reported during the fourth century BC in Greek armies operating in Armenia. In addition to total freezing of deep tissues, cold injuries include chillblains, trenchfoot, frostbite and immersion foot.

In view of today's engineering and construction work in far northern sections, there might be much of benefit in this fine book to engineers and managers responsible for work in such areas. The authors are Col. Tom F. Whayne and Dr. M. E. De Bakey. One of the Medical Department Historical series, it can be purchased from the Government Printing Office, Washington 25, D. C., for $6.25; 542 pages; many illustrations, some in color.

REINFORCED CONCRETE COLUMN TABLES

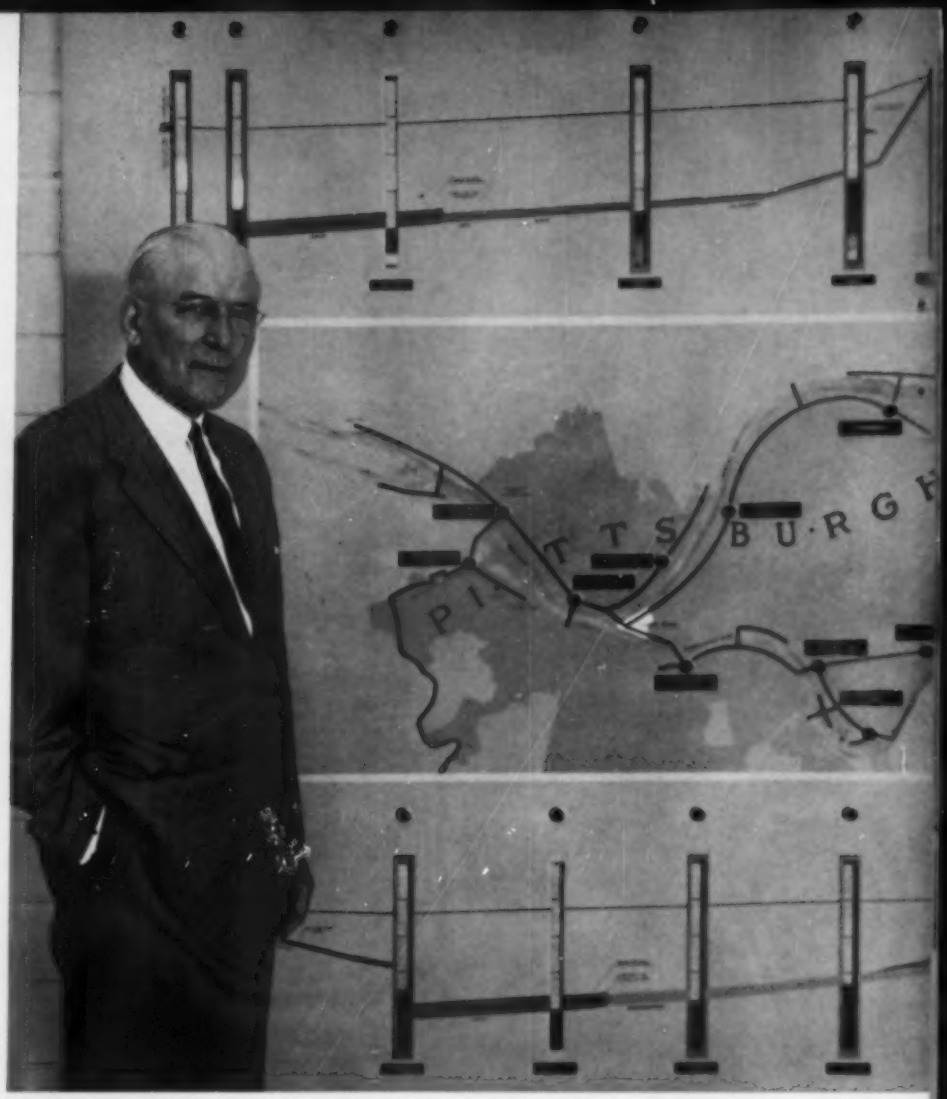
This is a "workbook" which contains 8,568 reinforced concrete column designs presented in 300 full-page tables. All computations are in accord with the ACI building code and cover rectangular columns up to 36 ins. diameter. Provision is made for four material strength combinations. In addition, column loads, maximum allowable loads, moment capacities and the size and arrangement of reinforcing bars are given. The book, the size of this page, is cloth bound. By Hugh F. Fenlon; F. W. Dodge Corp., 119 West 40th St., New York 18; $15.


YOU CAN BE SURE...IF IT'S Westinghouse
How Westinghouse helped
sewage treatment plant
Power-Up for 1970-1999 needs

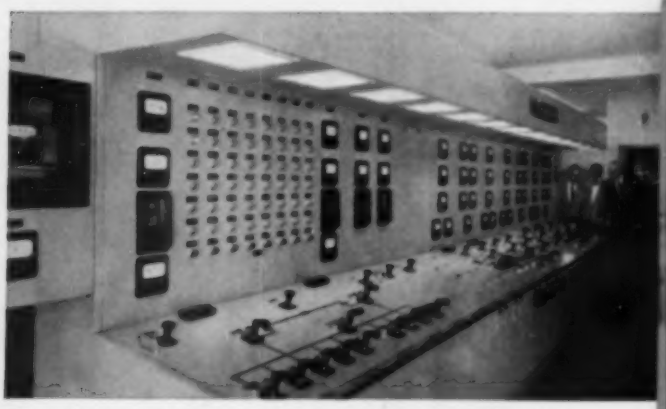
Front Cover: View in dry well of main sewage pump driven by Westinghouse 450/1250-hp 2-speed vertical synchronous motor in foreground. Constant-speed 800-hp motor in background drives its pump through a variable-speed magnetic coupling. Dry well is illuminated with Westinghouse VEK-16 floodlighting. Discussing installation are: A. B. Janaszek, Westinghouse Sales Engineer; M. B. Trimble, Westinghouse Construction Engineer; N. J. Grady, Devlin & Ernst, Electrical Contractors; J. F. Laboon, Executive Director and Chief Engineer, Allegheny County Sanitary Authority; A. A. Thomas, Engineer for Operations, Metcalf & Eddy, Consulting Engineers.

J. F. Laboon, Executive Director and Chief Engineer of Allegheny County Sanitary Authority, shown beside system flow panel of the $100 million trunk sewer and treatment plant project which serves 70 separate communities. The mimic diagram depicts flow conditions throughout a 69-mile network of tunneled interception sewers. The plant and its operation incorporate the process of concentrating undigested sludge for incineration.

J-94134-2



Examining sewage treatment system plans in the director's office are N. J. Grady, M. B. Trimble, A. B. Janaszek, J. F. Laboon and A. A. Thomas.



Over-all view of the main duplex control board installed in the sewage pump station. This board centralizes control of the incoming power feeders, indicates alarm conditions for each main sewage pump and also provides centralized control of pump motor speeds and performance. Shown at far end of control board are A. A. Thomas, A. B. Janaszek, J. F. Laboon and N. J. Grady.

Pittsburgh Sewage Treatment Plant builds for population growth of next 40 years

Planning by the Allegheny County Sanitary Authority went far beyond today's needs to anticipate the requirements of 1970 and beyond, to the year 2000. The new Pittsburgh Sewage Treatment Plant which serves the combined populations of 70 separate communities is now capable of handling the increased demands of 1970 populations. In addition, those structures and conduits which are not readily expandable are designed for the ultimate flow demands of the year 2000.

The Westinghouse electrical distribution system specified was planned with the same anticipation of future needs. Each component was selected to perform as part of the completely coordinated system. The entire system is capable of ready expansion to meet the increased power requirements of the future operating load of the plant.

Westinghouse electrical equipment supplied to Power-Up this 150-mgd sewage treatment project (max. rate, 300 mgd) includes:

- 10,000-kva outdoor substation.
- Main pump control board.
- Three main sewage pump motors (vertical, synchronous), 1250/450 hp, two speed, two frame.
- Two main sewage pump motors (vertical, synchronous), 800 hp, 400 rpm.
- Two major assemblies of high-voltage fused starters and metal-clad switchgear.
- Five indoor dry-type power centers (150 to 3000 kva).
- Seventeen motor control centers as well as panelboards, dry-type transformers and standard controls.
- Westinghouse Life-Line® motors and gear drives which are utilized on pump, conveyor and auxiliary drives.

(contd.)

YOU CAN BE SURE...IF IT'S

Westinghouse

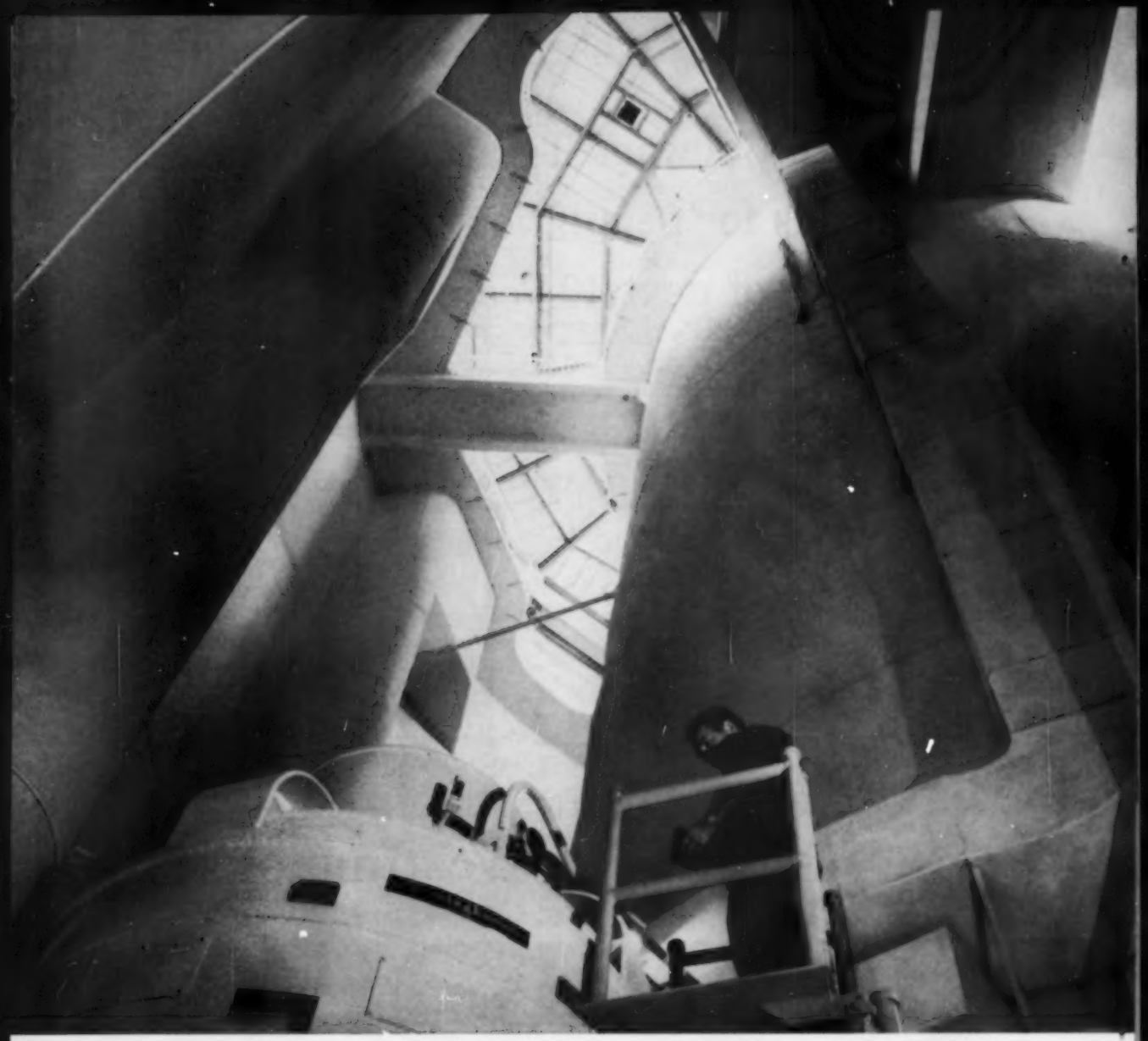
J-94134-3

General view of outdoor substation at Pittsburgh Sewage Treatment Plant. Shown is Westinghouse metal-clad switchgear used for incoming line, bus-tie and distribution service, as well as one of the 5000-kva oil-insulated power transformers at the station. Also shown are Westinghouse disconnect switches, grounding resistors and outdoor substation structure. M. G. Grasha, Plant Electrical Engineer, discusses installation with M. B. Trimble.

A. A. Thomas, J. F. Laboon, N. J. Grady and A. B. Janaszek shown in main control room with line-up of Westinghouse Ampgard* fuse starters for control of the main sewage pumping motors. Metal-clad switchgear in the middle of the assembly provides incoming line protection for each starter group.

*Trade-Mark

M. B. Trimble and M. G. Grasha inspect electrical equipment in administration building basement. At right is rear of motor control center close-coupled to 150-kva dry-type power center transformer; at left is a 75-kva Type DT-3 dry-type transformer feeding a Westinghouse NLAB lighting panelboard.



General view of main pump station looking from the bottom of the dry well up to the main operating floor level 120 feet above.

Sewage plant builds for next 40 years (contd.)

Powering-Up electrically for future growth provides many initial and future savings in public works projects. For information as to what such savings can mean to you, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94134-4

OWNER: Allegheny County Sanitary Authority
CONSULTING ENGINEERS: Metcalf & Eddy, Boston, Mass.
CONSULTING ARCHITECTS: Celli-Flynn, McKeesport, Pa.
ELECTRICAL CONTRACTORS: Devlin & Ernst, Pittsburgh, Pa.

YOU CAN BE SURE...IF IT'S Westinghouse

Over-all view of Pittsburgh Sewage Treatment Plant. In foreground are the main sedimentation tanks and the effluent channel which discharges into the Ohio River. Circular building at far right is main pump station, behind which is the incinerator building with 300-ft-high stack, a landmark of the installation.

Hersey Detector Meter Model FM
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For Emergencies:
INSTANT, UNIMPEDED WATER FLOW

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ACCURATE MEASUREMENTS OF ALL RATES OF FLOW

You get both with a

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Lead the Fight for Cleaner Waters

Win it with Trickling Filters with TFFI Specification Clay Underdrains

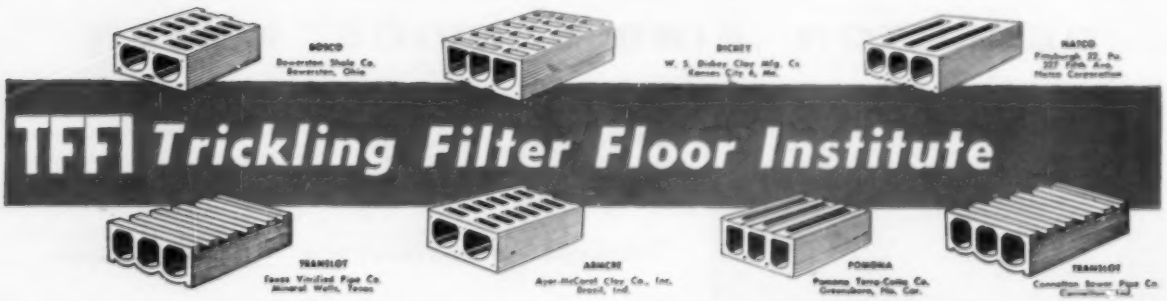
Shell Oil Company trickling filter, Wood River, Illinois. Photo courtesy National Slag Association.

Trickling Filters with TFFI Specification vitrified clay underdrain blocks make the winning combination for water pollution control. More of them have been built in the past 15 years than any other type. Together they offer economy, efficiency and ease of expanding the plant. In trickling filters your best assurance of long, trouble-free operation lies in the TFFI vitrified clay underdrains. They resist ravages of acids, alkalis and bacteriological action. TFFI manufacturers alone offer a 50-Year Guarantee as their blocks are made in modern plants under rigid controls of quality that no substitute material can approach.

Demand Certified Underdrain Block

Vitrified Clay Block manufactured by TRICKLING FILTER FLOOR INSTITUTE members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T.

Specifications are listed in insert at right and also in new TFFI Handbook.



SPECIFICATIONS

for vitrified clay filter blocks for trickling filters

A.S.T.M. DESIGNATION: C 159-59T

(Engineers using these specifications should check with A.S.T.M. to make sure that they have the latest edition.)

DETACH HERE

SCOPE

1. These specifications cover vitrified clay filter block made from clay or shale or mixtures thereof.

TYPES

2. **(a)** Two types of filter block are covered:

Type I. A one-piece filter block suitable for use in constructing a single-course trickling filter floor, that provides continuous drainage channels or ducts through the lower portion of the block for conveyance of liquids from the filter bed, and drainage and aeration grilles in the upper portion of the block for passage of liquids from, and air into, the filtering media.

One-piece filter block shall include: Type I-S, standard-rate block; and Type I-H, high-rate block.

Type II. A two-unit filter block system suitable for use in constructing a two-course trickling filter floor, that provides drainage and aeration. When placed or assembled, a course of the lower pieces or units forms continuous drainage channels or ducts for conveyance of liquids from the filter bed and for passage of air into the filter bed. An assembly of the upper units forms drainage and aeration grilles for passage of liquids from, and air into, the filtering media.

(b) When in position of use both types of block shall completely cover the floor of the trickling filter bed.

(c) The purchaser should specify whether block shall be Type I-S (Standard-rate), Type I-H (high-rate), or Type II.

COMPRESSIVE STRENGTH

3. **(a)** The average compressive strength of five full-size filter blocks shall not be less than 600 psi, based on gross area of block, with the load applied in the same direction as in service. No individual block shall have a compressive strength of less than 500 psi.

(b) Both component units of the Type II systems, tested individually, shall conform to the compressive strength requirement of Paragraph (a).

ABSORPTION

4. The average water absorption of five filter block, by 1-hr. submersion in boiling water, shall not exceed 6% of the dry weight of the block.

ACID RESISTANCE

5. Filter block shall be acceptable only when the percentage of acid soluble matter for specimens representing such block does not exceed 0.25% by weight.

SHAPE

6. **(a)** Type I filter block shall be square or rectangular in plan, as laid. When placed in parallel rows on the subfloor of the filter bed, cells in a single course of Type I filter block shall form continuous drainage ducts, and the apertures or slots shall provide for drainage and aeration of filter media.

(b) Units for the lower or drainage course and the upper or aeration course of Type II filter block shall be square or rectangular in plan, as laid. When placed in parallel rows on the subfloor of the filter bed, the lower units shall form continuous drainage channels. Upper units, when laid in parallel rows on the lower units, shall provide for drainage and aeration of the filter media.

PERMISSIBLE VARIATIONS IN DIMENSIONS

7. **(a)** Length, width, or height of a Type I filter block shall not vary by more than ¼ in. per ft. over or under the nominal dimension stated by the manufacturer.

(b) Lower drainage channels and upper aeration grilles of Type II block shall not vary by more than ¼ in. per ft. over or under the nominal dimension stated by the manufacturer.

FOLD FLAP OUT ▶

APERTURES

8. **(a)** Apertures in the top of Type I filter block shall be not more than 1½ in. in width, but may vary in length. Aperture area shall be not less than 20% of the top area of the filter block when in position of use.

(b) Apertures in the top, or aeration, course of Type II filter block shall be not more than 1¼ in. in width, but may vary in length. Clear unobstructed aperture area shall be not less than 30% of the top area of the block when in position of use.

SHELL AND WEB THICKNESSES

9. **(a)** Exterior walls (shells) of Type I filter block shall be not less than 9/16 in. in thickness, and interior webs shall be not less than ½ in. in thickness.

(b) Exterior walls (shells) and interior webs and struts of Type II filter block comprising the lower or drainage course shall be not less than 9/16 in. in thickness. Exterior walls (shells) and longitudinal webs of Type II filter block comprising the top or aeration course shall be not less than 1⅛ in. in thickness. Stiffening webs, for stiffening the longitudinal webs, shall not be less than 9/16 in. in thickness.

DRAINAGE CHANNELS

10. **(a)** Effective cross-sectional drainage area shall be defined and measured as the sectional area lying below the lowest level of the aperture slots. Aggregate effective cross-sectional area of drainage channels in a filter block shall be not less than shown in Table I.

Table 1 — Cross-Sectional Drainage Areas

	Minimum Effective Area Sq. in. per ft. of Width
One-piece systems:	
Type I-S, standard-rate	**20**
Type I-H, high-rate	**40**
Two-piece systems:	
Type II	**20**

(b) The shape of the bottom of the drainage channels of any filter block shall be curved or narrowed in width to form a trough in the bottom of each channel to accelerate flow of effluent and to minimize stranding of solids in such channels.

(c) The height of drainage channels in any filter block shall be not less than 2½ in., measured from the lowest level of the aperture slots.

(d) There shall be not less than two parallel drainage channels per ft. of width of a Type I filter block.

WORKMANSHIP and FINISH

11. **(a)** Filter block may be either glazed or unglazed, unless otherwise specified in the purchase order. If glazed filter block are specified, at least 90% of the inner and outer surfaces of the block shall be covered with glaze, excepting the wire-cut ends where it may be entirely absent.

(b) The lower bearing surface of filter block shall not vary from a plane by more than 3/16 in. per ft. of the greatest length or width of the block.

(c) All filter block shall be well burned and substantially free of laminations and fractures. All block shall be free of open cracks exceeding 1½ in. in length, and shall be free of other

cracks exceeding 3 in. in length that do not extend through the webs or shells. All block shall be free of chips larger than 2 x 1 x 3/16 in., and of blisters whose diameters exceed 2 in. and which project more than ⅛ in. above the normal surface.

MARKING

12. All filter block shall bear the name, initials, or trade mark of the manufacturer and shall be marked to show compliance with ASTM specifications C 159. These marks shall be indented on the exterior of the block and shall be legible.

REJECTION

13. If test specimens fail to conform to requirements for compressive strength, absorption or acid resistance, the manufacturer may sort the shipment, and new samples shall be selected by the purchaser from the retained lot and tested at the expense of the manufacturer. In case the second set of test specimens fails to meet requirements, the entire lot shall be rejected.

EXPENSE of TESTS

14. Except as specified in Section 13, expense of inspection and testing shall be borne by the purchaser.

SAMPLING and TESTING

15. **(a)** The purchaser or his authorized representative shall be accorded proper facilities for sampling and inspection of filter block, both at the place of manufacture and at the site of the work. At least ten days from the time of sampling should be allowed for complete tests.
(b) Filter block shall be sampled and tested in accordance with the Methods of Sampling and Testing Structural Clay Tile, (ASTM Designation: C 112) except that resistance of block to the action of acids shall be determined in accordance with the applicable portions of Sections 14 to 18 of the Methods of Testing Clay Pipe (ASTM Designation: C 301).

Members of the
TRICKLING FILTER FLOOR INSTITUTE

Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

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327 Fifth Ave.
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Pomona Terra-Cotta Co.
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GUARANTEE

OF VITRIFIED CLAY UNDERDRAIN FLOOR BLOCKS

The _____

of _____

Warrant and Guarantee to

_____

that all vitrified clay underdrain blocks manufactured by the above said company and furnished for installation in _____

_____ under contract dated _____

between _____ and _____

are proof against impairment of service or failure due to rust, corrosion, decay, chemical decomposition and/or disintegration caused by any action of acids, alkalis, sewage, sewer gases, ground waters or industrial wastes, excepting Hydrofluoric Acid only. Also guaranteed against destruction by rats, rodents or termites.

The undersigned bind themselves for a period of

FIFTY YEARS

after date hereof to furnish to the above named _____ free of cost, vitrified clay underdrain blocks in the same quantity and sizes equal to any of the vitrified clay underdrain blocks manufactured and furnished by above named manufacturer under said contract which may have been damaged, destroyed or impaired in service by reason of any of the above named causes.

It is expresly understood that the conditions of This Guarantee do not provide for Furnishing of Blocks which have been broken or impaired by reason of Improper Handling, Placement or Construction.

The _____ _____ Company

By _____ Title _____

Signed this _____ day of _____ 19____

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2 new permanent colors in GPX overlaid plywood

- GPX High Density now available in quantity in permanent colors in Turnpike Green, Turnpike White, Black, as well as Clear. Order any combination, overlaid one or both sides.
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47 hp* International T-340 crawler with Drott 4-in-1 Skid Shovel, most versatile of all earthmovers, pays off in winter use.

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For low-cost snow clearance around municipal buildings, it's an International Cub Lo-Boy and hydraulically-controlled 54-inch angle blade.

Speed all utilities maintenance operations and new construction with this low-cost fast-working rig—47 hp* International 340 with International Wagner loader and backhoe.

Equipment-planning aid for 1961! New catalog, *International Tractors and Matched Equipment*, gives key specs, helps you rate your 1961 job requirements against the most efficient International power size. Ask your IH dealer for a copy, or write International Harvester Company, Dept. PW-10, P. O. Box 7333, Chicago 80, Illinois.

INTERNATIONAL HARVESTER

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Better On-the-Job Sanitation

474. Portable chemical toilets for your work site—rented and serviced anywhere. Also available for picnics, parades, beaches and sports events. One-sheet circular gives full details. Address Sanitation Unlimited, 126-30 Willets Point Blvd., Corona 68, New York, or use reply card.

Packaged Sewage Treatment For Very Small Installations

477. Domestic sewage treatment for small developments, restaurants, schools, motels and other installations having flows up to 15,000 gpd can be handled in the single-tank CompleTreator. Compact, easily installed and simple to operate. Complete data in Bulletin 7315 of Dorr-Oliver, Inc., 77 Havemeyer Lane, Stamford, Conn. Use the inquiry card.

Design Data on the "Spirahoff"

478. The "Spirahoff," a single-structure primary sewage treatment plant, is fully described and design data, operational characteristics and specifications furnished in Catalog 300 of Yeomans Brothers Co., 1999 N. Ruby St., Melrose Park, Ill. Check inquiry card for your copy.

Wedge-Lock "O" Ring Joints for Vitrified Clay Pipe

482. Joints for large diameter pipe, using the Wedge-Lock principle of factory made joints plus a rubber "O" ring for compression sealing, described in 4-page folder of Evans Pipe Co., Uhrichsville, Ohio. Check reply card for your copy.

What Henry Didn't Know About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

Manual of Pumping Data

488. A new 20-page manual entitled "Useful Pumping and Hydraulic Engineering Data" is available from Peerless Pump—Hydrodynamics Div., 301 West Avenue 26, Los Angeles 31, Calif. Check inquiry card for your copy.

The Vital Link for Your Snow Plows

491. A plow is useless until it is hitched to truck or tractor. Versatile hitching equipment described and illustrated in circular offered by Kasten Mfg. Co., Allentown, Wis. Write them or check card number for your copy.

The Wheel Tractor and What It Can Do

494. Here is a new 24-page full-color brochure that lists and illustrates wheel tractor models and their multi-purpose attachments. Handy "Quick-Specs" give size and design details. For your copy write Massey-Ferguson, 1009 South West St., Wichita 13, Kans.

What Latex Does to Portland Cement

498. For resurfacing, bridge decks, mass exterior placements and highways, latex offers many potentialities. To point out uses and application procedures, a 16-page cartoon-illustrated booklet titled "Field Handling and Placement of Latex Modified Portland Cement" has been published by the Dow Chemical Co., Plastics Dept., Midland, Mich. Check the inquiry card for your copy.

Concrete Pavement Design for Parking Areas

501. . . . is the title of a most useful 16-page booklet that covers its subject from specifications through construction to the finished job. Clear and concise how-to-do-it treatment, bound to prove helpful. Write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill., or use our card.

What's New in Sweeper Broom Renewals? . . . This!

509. Real speed in sweeper broom renewals is offered with the Radax broom coil, a ready-made refill that uses long wearing plastic filament. Prefabricated units are compact to store, easy to slip onto broom core. Get the details on this new approach to the renewal problem by writing Rynal Corp., 114 St. Joseph St., Arcadia, Calif., or use the inquiry card.

Designers and Buyers Guide to Preferred Lighting

526. The five main considerations in selecting roadway lighting equipment, application data for all traffic conditions and complete product data are contained in a 28-page illustrated booklet published by General Electric Co., Outdoor Ligting Dept., Hendersonville, N. C. Circle number on our inquiry card to get your copy.

To Make a Clean Sweep

502. Both large and small communities find Mobil Sweeper models that meet their needs. For details on performance, economy and safety get the "Mobil Sweeper" booklet from The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. Check our card-number.

"Hottest Street Patcher in Town after Town"

506. This is the modest title of a circular depicting and describing portable heated rollers for the patching crew. Well worth your attention. Get it from Ellis Distributing Co., Box 168, Liberty, Mo., by checking reply card.

New Dempster Book

587. . . . tells the full, illustrated story of what Dempster Brothers offer in the way of waste collection, containerization and disposal equipment. 28 pages in color. Get your copy from Dempster Bros., Knoxville, Tenn., or circle our reply card.

How to Care for Pump Motors

514. A collection of technical articles covering many aspects of pump motor maintenance has been reprinted and made available by U. S. Electrical Motors Inc., Box 2058 Terminal Annex, Los Angeles 54, Calif. Check reply card for your copy.

27 Diesel and Carbureted Engines Detailed in one Booklet

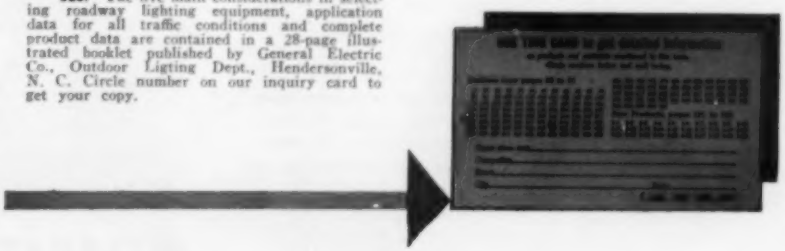
527. Describes and illustrates all types, from 16.4 to 385 hp., in weights 279 to 6,045 pounds. A brief, handy way to review available industrial engines. To get your copy, write for pamphlet CR-764-K to International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. or circle the number on our card.

If You Have Small Sewage Flows to Purify

528. Here is a valuable new 12-page booklet on Aerobic Digestion plants, especially useful for institutions, airports, and other places off the municipal sewer system. Ask for Bulletin SM-1010 from The Eimco Corp., P. O. Box 300, Salt Lake City 10, Utah, or you can check number on our card.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.



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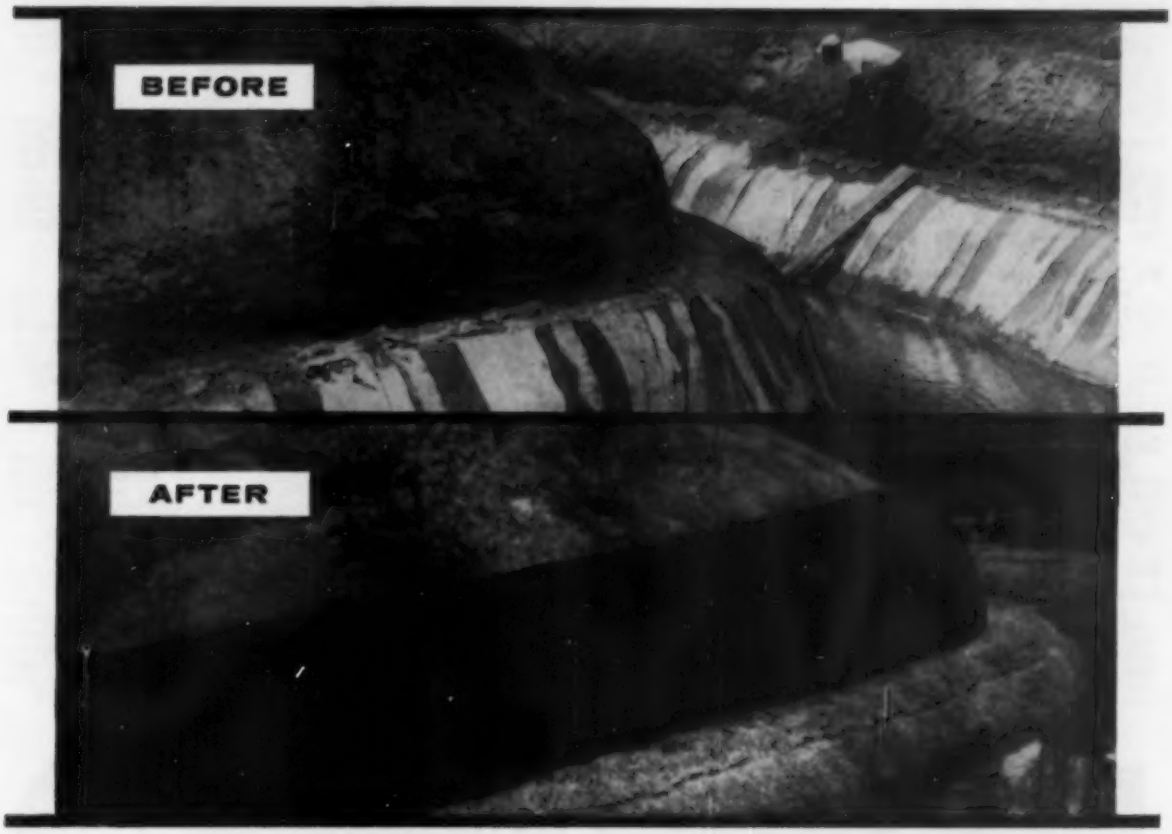

How Troyturf—the modern, guaranteed method to grow grass—answered the need at Freedomland!

Freedomland's problem was to grow a lasting stand of grass *quickly*. They chose the modern way to produce a quick growth of lush grass in their "impossible" locations... locations such as gulleys... embankments and ravines. They chose Troyturf.

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Get the facts now. Learn about the wide range of formulations available...of successful uses by highway departments and others. Send for complete information and sample today.

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TROY BLANKET MILLS Troy, New Hampshire

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To order these helpful booklets check the reply card opposite page 44.

NEW LISTINGS (Cont.)

Discourage Those Discouraging Pipe Leaks

531. With Quick-Bolting Redi-Clamps and neoprene Sta-Grid Gaskets that lower inventory costs and space requirements. Single clamp makes wide range of repairs. Full details are in circular 234 to be had from Smith-Blair Inc., 535 Railroad Ave., South San Francisco, Calif. or circle number on the card.

Sludge Density Control

534. Application data for sludge density control system using gamma radiation source for density measurement and control. Described in Bulletin SD-1 from The Ohmart Corp., 2236 Bogen St., Cincinnati 22, Ohio. Or you may check our card by its number.

Big Tractor-Powered Equipment

540. Including tractor shovels, dozers, scrapers, loggers and special equipment models and features illustrated and described in attractive brochure available from Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich. Or just check number on our card for us to order for you.

Versatile Trenchers Mount On Jeeps or Tractors

504. "Gear-Draulic" boom-type trenching attachments by Auburn mount on tractor or Jeep, give new utility to your equipment. Get descriptive brochures from Auburn Machine Works, Inc., Auburn, Nebraska. Use the inquiry card.

Make Blueprint Filing Easier and More Efficient

542. A blueprint rack for engineering departments that is made of steel and is equipped with 12 plan holders is described in literature available from Momar Industries, 4323 West 32nd St., Chicago 23, Ill. Check the reply card for price list and the advantages of this easy to move and complete unit.

Floatless Liquid Level Controls

543. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Underdrain Blocks For Trickling Filter Beds

544. "Natco Tri-Filter" blocks are one piece salt glazed units, produced for both standard and high rate trickling filter systems. Shape details and sizes furnished in Bulletins TF-5 and TF-8, available from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Tough Mowing Jobs Made Easy

546. . . . with the new extra-duty Jacobsen Ram Rotary mower. Cuts smooth on rough terrain. For full description of its versatility write for literature now. Address Jacobsen Mfg. Co., Dept. PW, Racine, Wis., or check the inquiry card.

Sees 'em and Seals 'em

548. Leaking joints in storm and sanitary sewers are detected and sealed by the new Centriseal Process. It's all done by remote control, constantly monitored by television. Get all the details by writing Centriline Corp., 140 Cedar St., New York 6, N. Y., or check the inquiry card.

●

REFUSE COLLECTION AND DISPOSAL

Versatility, Compaction Force Account For Extra Packer Capacity

139. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galion Products, Inc., Galion, O.

Incinerators for the Disposal of Combustible Wastes

217. Bulletin 184A from Morse Boulger Inc., New York 11, N. Y. describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

General Specifications for Refuse and Garbage Trailers

231. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dumpster are available from Pak-Mor Manufacturing Co. Box 14147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis Chalmers Mfg. Co., Milwaukee, Wis.

Pushbutton Refuse Collection

469. Pushbutton control of the packing cycle is just one of the many features of the Mark II Collectomatic refuse collection unit. In addition the unit offers fast, safe loading; "Duo-Press" compaction; positive ejection without raising body; simplified maintenance. 13, 16 and 20 yd. capacities. For all details get Bulletin BH-60106 from The Heil Co., Milwaukee 1, Wisc. Use the inquiry card.

Synchro-Start's new protective engine controls have been designed, for the starting and stopping of engines from remote pilot devices, such as pressure switches, float switches, power failure relays, etc., and are completely automatic in operation. These dependable controls are encased in a steel, dust proof cabinet, and now feature enclosed PLUG-IN RELAYS as well as OVERLOAD BREAKERS. The plug-in relays simplify what little field maintenance that may have been required in older models, while the overload breakers eliminate the necessity of replacing fuses.

In designing this unit we have used the same high quality materials and workmanship that our customers have come to expect throughout Synchro-Start's 27 years of manufacturing engine controls.

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Everyone's remark when they see the startling RADAX Broom Coil demonstration. Never before anything like it—for low price—for speed—for long life and—users say it sweeps better than any broom they have ever had!
• NO CORES TO BUY
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5 minutes or less for a new refill-READY TO GO!
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MOBILE 58" BROOM | $208.30 | $310.60
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ELGIN STREET KING | $258.20 | $388.10
ELGIN WHITE WING | $258.20 | $388.10
ELGIN 20, 30, and 81 | $270.15 | $399.95
AUSTIN-WESTERN 40 | $208.15 | $303.55
AUSTIN-WESTERN 60 | $230.75 | $333.20
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You can depend on it that Cast Iron Pressure Pipe will last 100 years or longer in your city's underground mains. Properly installed, maintenance costs are negligible — little or nothing — because of its effective resistance to corrosion and its wide margin of safety in strength to withstand impact, beam and crushing stresses.

If your community expects to grow, *now* is the time to plan ahead for adequate Cast Iron water mains that will give dependable service for a century or longer.

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To order these helpful booklets check the reply card opposite page 44.

SEWERAGE AND WASTE TREATMENT

Handbook on Spiraflo Clarifier Design

28. Comprehensive 36-page Bulletin 126 gives details of clarifier design, operating results, applications and full specifications for the Spiraflo clarifier for water and waste treatment. To get your copy check the reply card or write to Lakeside Engineering Corp., 222 West Adams St., Chicago 6, Ill.

To Avoid Paint and Coatings Errors

50. First consult "A Catechism on Categories of Corrosion," a pocket sized brochure that enables you to share the expert knowledge of Hercules Powder Co., Cellulose Products Dept., Wilmington 99, Del. Finding out is free; not knowing could be costly.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Transite Pipe For Sewer Mains

166. Johns-Manville "Transite" Sewer Pipe, made of asbestos-cement, is available in 11 different diameters ranging from 6" to 36" and in five new crushing strengths to permit greater efficiency in system design. "Ring-Tite" Coupling, designed for high-speed assembly, provides tight, long-lasting seal. Easy-to-assemble Transite sewer fittings also furnished. For complete information, write for brochure TR-165A (Transite Sewer Pipe), TR-94A (Sewer Design Flow Chart), and DS-366 (Transite Material Specification). Johns-Manville, 22 East 40th St., New York 16, N.Y. Check reply card.

What You Should Know About Trickling Filter Underdrains

30. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Stationary Diesels For Water and Sewage Plants

147. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #115A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

A Short Course In Pipe Jointing

149. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Package Sewage Plants for 50—5000 Population

181. Design information on Walker "Sparjair" package sewage treatment plants for sizes from 50 to 5000 population equivalent is presented in a 12-page bulletin, No. 19-S-94. Typical plans and sections, special design considerations, specifications and a discussion of the "how" and "why" of the contact stabilization process are included. Check the inquiry card or write Walker Process Equipment, Inc., 840 No. Russell, Aurora, Ill.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Guide Book Information for Emergency Power

183. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful datz by checking reply card.

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Readers' Service Booklets Appear on Pages 40 to 58

20	57	104	153	194	236	304	365	407	438	478	502	528	544	586	698
22	62	109	159	195	237	305	367	408	461	482	504	531	546	603	
24	64	118	160	198	240	314	368	409	462	483	506	532	548	616	
27	76	120	162	201	247	315	371	416	465	488	507	533	550	645	
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42	84	131	172	213	281	338	394	434	474	496	514	540	568	688	
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51	95	141	183	218	294	341	398	437	477	501	527	543	575	694	

New Equipment Items Appear on Pages 216 to 223

10-1	10-3	10-5	10-7	10-9	10-11	10-13	10-15	10-17	10-19	10-21	10-23	10-25	10-27	10-29	10-31
10-2	10-4	10-6	10-8	10-10	10-12	10-14	10-16	10-18	10-20	10-22	10-24	10-26	10-28	10-30	10-32

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Meetings and Conventions

Water Pollution Control Federation
(Formerly the Federation of Sewage & Industrial Wastes Assn.)
The Trade & Convention Center, Philadelphia, Pa., Oct. 2-6. Exec. Sec., Ralph E. Fuhrman, 4435 Wisconsin Ave., N. W., Washington 16, D. C.

19th Annual Short Course on Roadside Development
State Office Bldg., Columbus, Ohio, Oct. 4-7. Wilbur J. Garmhausen, State of Ohio, Dept. of Highways, Columbus 15, Ohio.

Southeastern Conference on Urban Planning for Mobile Homes
Architecture Bldg., Georgia Institute of Technology, Atlanta, Ga., Oct. 6-7. Director, Short Courses and Conferences, Richard Wiegand, Georgia Institute of Technology, Atlanta, Ga.

Wire Reinforcement Institute
Garden of the Gods Club, Colorado Springs, Colo., Oct. 10-11. Managing Director, Frank B. Brown, National Press Bldg., Washington 4, D. C.

American Society of Civil Engineers
Hotel Statler, Boston, Mass., Oct. 10-14. Exec. Sec., William H. Wisely, ASCE Hdqrs., 33 West 39th St., New York 17, N. Y.

City and Village Public Works School
(Arranged cooperatively by the Conference of Mayors and other Municipal Officials of the State of New York, and Cornell University), Hollister Hall, Cornell University, Ithaca, N. Y., Oct. 13-14. Write: J. W. Spencer, Dept. of Agricultural Engineering, Riley-Robb Hall, N. Y. State College of Agriculture, Ithaca, N. Y.

Canadian Institute on Sewage and Sanitation
Sheraton-Brock, Niagara Falls, Ontario, Can., Oct. 23-26. Sec.-Treas., Dr. A. E. Berry, Administrative Office, 72 Grenville St., Toronto, Ontrio, Can.

9th Annual Water Works Management Short Course
(cosponsored by the Illinois and Indiana Sections), Allerton Park, Monticello, Ill., Oct. 24-28. Write: T. E. Larson, Head, Chemistry Sec., State Water Survey Div., Box 232, Urbana, Ill.

Florida League of Municipalities
Hotel George Washington, West Palm Beach, Fla., Oct. 30, 31 and Nov. 1. Write direct to Hotel George Washington for reservations.

American Public Health Assn.
Civic Auditorium, San Francisco, Calif., Oct. 31-Nov. 4. Exec. Dir., Dr. Berwyn F. Mattison, 1790 Bornsdway, N. Y. 19, N. Y.

Robert A. Taft Sanitary Engineering Center Courses:
Nov. 7-11, "Radioactive Pollutants in Water"; Nov. 14-18, "Radioactivities in Water." Chief, Training Program, 4676 Columbia Pkwy., Cincinnati 26, Ohio, or to USPHS regional office.

American Bridge, Tunnel and Turnpike Assn., Inc.
Sheraton-Atlantic Hotel, New York, N. Y., Nov. 14-17. Exec. Sec., J. Allyn Stearns, Northcourt Bldg., 178 Main St., White Plains, N. Y.

American Assn. of State Highway Officials
Nov. 27-Dec. 2. Write: A. E. Johnson, 917 National Press Bldg., Washington 4, D. C.

American Road Builders' Assn.
Chalfonte-Haddon Hall, Atlantic City, N. J., Mar. 5-8, 1961. Vice Pres., Louis W. Prentiss, 600 World Center Bldg., Washington 6, D. C.

American Water Works Assn.
Cobo Hall, Detroit, Mich., June 4-8, 1961. Sec., Raymond J. Faust, 1 Park Ave., New York 16, N. Y.

Institute of Traffic Engineers
Sheraton-Park Hotel, Washington, D. C., Week of August 20, 1961. Write: David M. Baldwin, Institute of Traffic Engineers, 2029 K St., N. W., Washington 6, D. C.

American Public Works Congress & Equipment Show
Municipal Auditorium, Minneapolis, Minn., Sept. 24-27, 1961. Sec.-Treas., Robert D. Bugher, 1313 East 60th St., Chicago 37, Ill.

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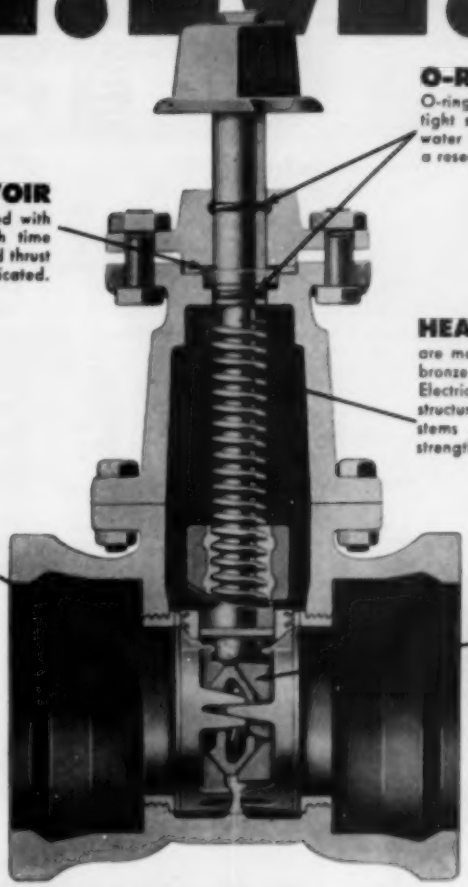

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Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave. Boston 34, Mass. Check the reply card.

Bulletin on Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Learn About Positive and Easy Valve Operation

304. "LimiTorque" Valve Operators provide push-button control that enables one man to open and close any type of valve quickly and dependably, provide full protection from damage during closing cycle due to torque limiting mechanism. LimiTorque is available for operation by any power source and is readily adaptable to all types of remote control. Catalog L-550 completely describes and illustrates operation and installation. Philadelphia Gear Corp., King of Prussia, Penn.

Sludge Disposal by Incineration

314. . . . is the subject of an informative brochure put out by a leader in the field. Both public works engineers and lay officials will find it lucid in style, enlightening in the presentation, well illustrated. For your copy write Nichols Engineering and Research Corp., 80 Pine St., New York 5, N. Y., or circle our card-number here.

Engineering Data Manual on Underground Lift Stations

218. This 100 page manual includes descriptive bulletins, specifications covering typical installations for pump type or ejector type stations, friction loss tables covering capacities and size of pipe, pump and motor selection charts and wiring diagrams. Check the reply card or write Smith & Loveless, Division-Union Tank Car Co., Lenexa, Kansas.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1132 W Blackhawk St., Chicago 22, Illinois.

Roots Seeking Entry into Your Sewers

315. . . . give up in despair when confronted with pipe joints made with Atlas JC-60 plastic base sewer joint compound. Engineering data are presented in Bulletin M20-3. For your copy write Atlas Mineral Products Co., Mertztown, Pa., or check our card.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Sludge Pumps That Can Take It

436. Built by specialists in sewage treatment equipment, these new Dual Valve sludge pumps are described in fact-filled folder written to fit designing engineers' needs. For your copy address Komline-Sanderson Engineering Corp., Peapack, N. J., or circle our card.

Descriptive and Performance Data on Sump and Sewage Pumps

483. Performance tables, selection charts, architect's and engineer's specifications and descriptive bulletins on Pacific sump and sewage pumps are available in complete catalog from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

Clean Sewers Cost Less Than New Ones

554. Here is news on 1960-models sewer-cleaning equipment that can keep money in your municipal pocket. To get latest literature on the O'Brien line just write O'Brien Manufacturing Corp., 5632 Northwest Highway, Chicago 46, or check the card.

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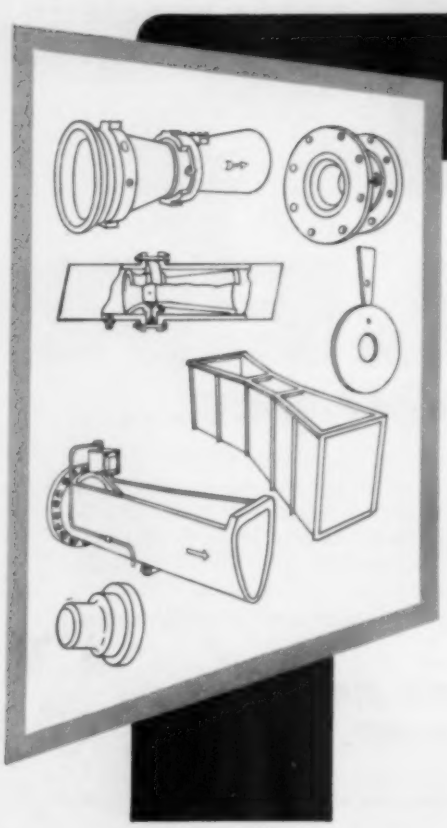
688. The Weil submersible sewage and sump pumps actually offer a choice of two motors, two controls. MICRO switch controls start and stop pumps, alternate pumps, and to provide high water alarm. Get Booklet SE-860 for complete engineering information from Weil Pump Co., 1526A N. Fremont St., Chicago 22, Ill., or circle card number

(More Listings on page 50)



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To order these helpful booklets check the reply card opposite page 44.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

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645. An 80-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for the third revision of this valuable book containing new tables for evaluating flow friction.

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Controls for Water and Sewage Pumps

428. Condensed data sheet gives you valuable information on applications and operation of Roto-Trol controls. Before you design automation in pump service, write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check card number.

Small Unit Sewage Treatment For 20 to 5000 People

568. Bulletin 135A describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14 Ill.

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24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 100 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill.

How to Select Right Angle Drives

42. Data-filled Catalog 31 of Johnson Gear & Mfg. Co., Ltd., 8th & Parker Sts., Berkeley 10, Calif., makes it easy to select the correct right-angle gear drive for 3-ep well turbine and other vertical shaft pumps. Includes details on the Johnson "Redi-Torq" gear drive. To get your copy just check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

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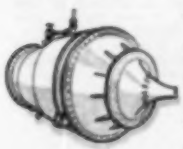
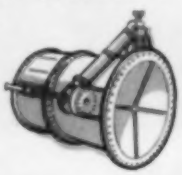
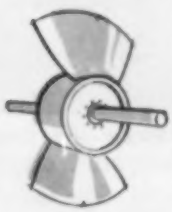




All can be used for free discharge or bypass and all can be operated manually, hydraulically or by electric motor. Often used in conjunction with each other are two more valves built by Pelton—automatic dashpot-controlled air valves, widely used in flow lines, and surge suppressors. The latter afford excellent protection for pump discharge lines, preventing excess pressure when the pumps are stopped. All the valve types mentioned here can be run with the Pelton Motor Operator, which uses a planetary gear system (thus eliminating the clutch) and which provides torque protection in both directions at no extra cost. We might also mention one other kind of Pelton water control equipment—axial flow pumps. These may be equipped with either fixed blade or variable pitch impellers. Where low or medium head, high operating efficiency and large discharge capacity are important factors, Pelton pumps can provide the answer at relatively low cost.



For further information on any Pelton valves or pumps, write Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif,. or B-L-H Corporation, Philadelphia 42, Pa.

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Facts About Transite Pipe for Water Mains

121. Engineers can secure four pieces of illustrated literature that cover installation, operation and maintenance economies of Transite and Ring-Tite couplings for pressure mains. DS-335 is a material specification. TR-15A a Friction Loss of Head and Flow Powergraph, TR 62A an Installation Guide, and TR-160A in-service characteristics and case histories of water pipe. Tables of weights, sizes, pressure classes included. Address Johns-Manville, 22 E. 40th St., New York 16, N. Y., or check above number on card.

Why Hunt All Over the Place?

201. Instead, use this 32 page cross-indexed catalog for quick easy reference equipment, trade names and applications. Covers all major equipment in the complete Infilco line. Write for Bulletin 80 to Infilco Inc., P.O. Box 6033, Tucson, Arizona.

U. S. Tyton Joint Pipe

210. An eight page booklet on centrifugally cast, Tyton Joint® pipe for water or other liquids is available. Tyton Joint cast iron pipe is provided with a simple, sturdy and tight slip-on type of joint. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 57 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Do You Know ALL About Meter Settings?

132. If not, this new book will not only surprise you but help you with its wealth of information. It is a comprehensive treatise on a subject commonly ignored in textbooks. Any water works man can profit by having it. To get yours, just write The Ford Meter Box Co., Wabash, Ind., or circle number on inquiry card.

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141. Electric, fully submersible, portable, runs dry without damage, no priming, and other outstanding advantages. All are described in Flygt Bulletin B-801. of Flygt Corp., Hoosick Falls, N. Y. Address them or just circle the number on our card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or Write to The Preload Co., Inc., 355 Lexington Ave., New York 1, N. Y.

Submersible Pumps For Municipal Use

341. A new 12-page bulletin that describes the line of BJ submersible pumps is available from Byron Jackson Pump Inc., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. Construction and operation of the pumps are covered along with a handy selection chart that gives capacity and head performance.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Electrical Equipment for Water Works

488. Whether it is motors, generators, motor-generator sets, switchgear or controls, Ideal offers performance and dependability in these vital parts of water plant operation. For details get Bulletin 505 from Ideal Electric & Manufacturing Co., 370 East First St., Mansfield, Ohio, or use the inquiry card.

Measurement of Liquid Flow Across Weirs

418. The Burgess-Manning Type ML meter is applied to weir boxes for measurement of flow across any V-notch weir or parshall flume. For specifications and installation procedures write Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa.

A Flat Statement About Round Tanks

434. The title of a new finely illustrated booklet is "Steel Tanks Store Water Best." It gives pictures, essential data, and a fine impression of strength, water-tightness and beauty combined in sturdy structures. For your copy write Steel Plate Fabricators Association, 105 W. Madison St., Chicago 2, Ill., or check our card.

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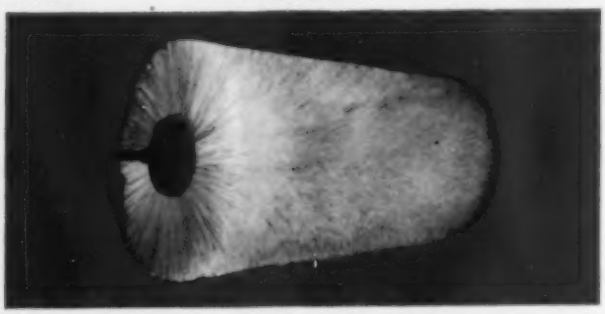

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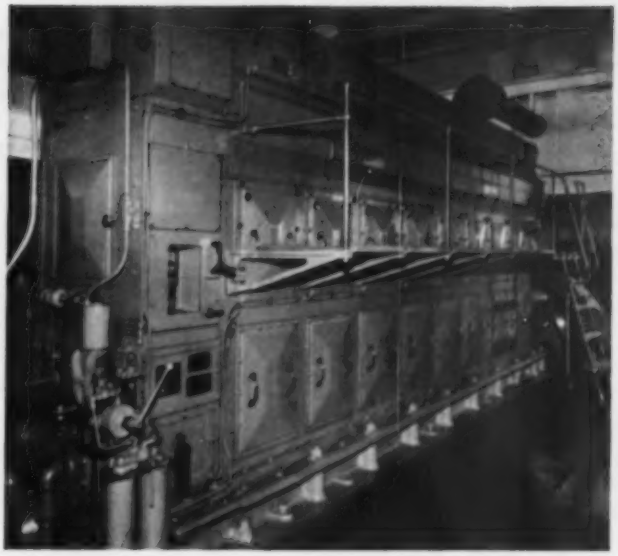

**Superior 80-SX-8 Diesel at Princeton, Missouri, produces 15-25% more power per gallon fuel oil than comparable engine-generators!*

For the past three years, Consumers Public Service Company of Brookfield, Mo., has achieved remarkable fuel economy with a White Superior Model 80-SX-8 engine-generator package installed at Princeton. The Superior is rated 1440 HP at 360 RPM and drives a generator of 1000 KW capacity. This dependable combination produces over 15 KWH of electricity per gallon of fuel oil, which is 15-25% more power per gallon than comparable engine-generators commonly produce!

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White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

To order these helpful booklets check the reply card opposite page 44.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Outline of Modern Water Treatment Equipment

348. Bulletin 4417 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

To Meet Increasing Water Demands, These Two Steps Will Help

247. Two new products designed to help meet constantly increasing demands for water are described in a folder of Hersey-Sparling Meter Co., 250 Elm St., Deham, Mass. These are a flow analyzer that provides strip chart rate of flow and volume records, and a two-rate register that can be substituted for the flow analyzer. Get this data by checking our reply card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 23, Wisconsin.

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Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card

Standardization of a Complete Line of Water Service Equipment

389. Standardization can be a handy thing where the line includes stops, boxes, clamps, strainers, and meter setting equipment. You can find it all at Mueller Co. Address them at Decatur, Ill. for folder W-8880 or just circle the number above on our card.

Valves to Operate?

416. Then get the data on how Pelton can do the work for you and do it better. 4-page Bulletin No. 49 tells and pictures all. Just address Pelton Div., Baldwin-Lima-Hamilton Corp., 2929 19th St., San Francisco 10, Calif. or check our card.

Broad Line of Meters, Feeders, Controls

437. . . . is now out in a revised booklet form. Includes card for securing precise product information you want in the water, sewage and wastes treatment field. Ask for Bulletin Ref. No. 0001-20-1, from B-I-F Industries, P. O. Box 1342, Providence 1, R. I.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Locate Water Leaks Quicker and Easier

476. An aquaphone that requires no mechanical connection between probe and diaphragm to break or cause of trouble is described fully in literature from Aqua Survey & Instrument Co., 824-B North Bend Rd., Cincinnati 24, Ohio.

A New Note in Waterworks Brass Goods

492. The Hays line covers everything from curb stops to tapping machines. Beautifully illustrated catalog is packed with information to help you buy the best. To get your copy write Hays Mfg. Co., Erie, Pa., or check the card.

Play Safe with Automatic Controls

603. Remote engine and pumping controls of every sort are fully described in a series of bulletins offered by Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Write them or circle the above number on our card.

Cast Iron Pipe That Bends Under Stress

683. This cast iron pipe from 2 through 48 ins. has as advantages extra strength, high resistance to impact, bendability, greater reliability, ample wall thickness and adaptability. Check the reply card or write American Cast Iron Pipe Co., Birmingham, Ala., for full specifications.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Measure Water Accurately In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

CITY OF PONTIAC, MICHIGAN, keeps its new Huber-Warco 10-D motor grader busy on a variety of new construction projects. It is pictured cutting the finish grade on West Colgate Street, which was paved with hot-mixed asphalt.

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RUGGED CONSTRUCTION—Heavy-duty frame, circle, drawbar, drive units and other components, combined with dependable diesel engines, assure years of low-cost service on any type of grading assignment.

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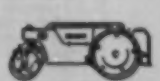

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CONSTRUCTION EQUIPMENT AND MATERIALS

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22. On tractor loaders, motor graders and tractor shovels, Allis-Chalmers keeps bringing out new literature that is well worth your while. Ask them for it, specifying where your interest lies. Write Allis-Chalmers Mfg. Co., Tractor Group, Box 512, Milwaukee 1, Wis. or circle our card.

Don't Stand There Figuring!

51. Use the new Forney PSI Calculator "slide rule" for concrete products that includes instant conversion data from total load to psi on 17 standard test specimens and masonry units. Pocket size. Free. Address Forney's Inc., Tester Div., Box 310, New Castle, Pa.

Backfill Rammer Packs a Heavy Punch

120. Powerful Wacker Model GVR 100-C Rammer weighs only 115 pounds so it's in the Bantam-weight class, but it delivers ten powerful blows per second to compact 20 square feet per minutes. Durable, compact and easy to operate, it gets into tight corners and meets toughest compaction requirements. Full details from Wacker Corp., Hartford, Wisc.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful four color booklet you will find details on several basic designs for community use; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co. 7321 East 13th St., Kansas City, Mo.

For Prompt Service Use The Reply Card

Power-Controlled Motor Graders

330. Three models of motor graders with torque converters and power shift transmissions are described in detail in bulletins, No. HWG-521 and HWG-508 available from the Huber-Warco Co., Marion, Ohio.

When You Need Sand Blasting There's Nothing Like the Jet-Blaster

398. . . . for economy, efficiency and ease of operation. As first step toward making old surfaces look new get latest bulletin by addressing Air Placement Equipment Co., 1000 West 25th St., Kansas City 8, Mo., or check number on the card.

Tractors and Equipment for Municipal Use

407. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations. John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

To Increase Your Public Works Efficiency

561. Ask now for the new "Modern Methods and Equipment" booklet that spells out how other officials have applied IH equipment to everything from earth moving and trenching, from snow plowing and road building to pipe laying and electric power plants. Write International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check our card.

Catalog on Utility Bodies and Equipment

698. General Service Bodies; Maintenance Bodies; Line Construction Bodies; Mechanical and Hydraulic Aerial Ladders; SKY-MASTERS (Aerial Devices); Winches; Hydraulic Derricks; Pole Trailers; Hydraulic Cable Reel Trailers; and Related Accessory Items of Equipment. Write McCabe-Powers Body Co., 1900 N. Broadway, St. Louis 15, Mo

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Clarke Summit, Pa.

Save on Winter Ice Control Cost

237. . . . with the faster-working salt described in this new Bulletin B-11595. Tells what this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects. Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our card.

Snow Plows For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N. Y.

Hydraulic Controls Make Snow Plowing Easier

368. Hydraulically operated power controls may be readily installed on trucks that will plow snow this winter. Start preparing now to make winter maintenance an easier job. Get illustrated folder from Monarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Use the inquiry card.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wisc., or check our card number.

Catalog on Equipment For Ice and Snow Control

468. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co., Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

All-Weather Spreader for Standard Dump Trucks

472. Get data on the new "Rollgate" hydraulically driven roll-type spreader that applies uniform amounts of salt, sand, cinders or other materials up to 1 inch diameter over an 8-ft. width. Write Good Roads Machinery Corp., Minerva, Ohio, or check the inquiry card.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

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31. is good street lighting in preventing crime. To guide you to better lighting there is a new Kerrigan booklet. "A Bright City is a Safe City." Describes full line of lighting standards, also how to promote better lighting in your city and county. Address, Lighting Standard Div., Kerrigan Iron Works Co., 1033 Herman St., Nashville, Tenn. or use our card.

Highway Lighting Engineering Guide

207. This catalog is primarily aimed at the new highway lighting program that is being undertaken nationally. It gives data on the quantity of light required; lighting on main traffic lanes, interchanges, intersections, toll plazas and bridges. It also covers information on the relative cost of lighting and the selecting of the light source. Write to Westinghouse Electric Corp., Lighting Div., 1216 West 58th St., P. O. Drawer 5817, Cleveland, Ohio.

Complete Catalog on Traffic Control Equipment

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

Manual on All Types of Traffic Signs

279. This 26-page manual covers regulatory, warning, school, railroad, street name road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 182 East Second St., Wichita 14, Kans.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave., S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Literature on Reflective Glass Beads

571. Glass beads for traffic signs and street name signs are described in literature available from FLEX-O-LITE MFG. CORP., 8301 FLEX-O-LITE DRIVE, P. O. Box 3066 (Affton Br.) St. Louis 23, Mo. No. 831 high index of refraction glass beads for white and yellow backgrounds and UB 68 medium index of refraction glass beads for reflectorizing dark colors such as red, green, blue, etc.

Let Progress Hit Your Highway Signs, too

575. An overlaid plywood especially engineered for highway sign construction is now available in natural surface for reflective overlays, also in green or white. AASHO approved. Resistance to damage cuts maintenance costs. For GPX description and specifications write Georgia-Pacific Corporation, Equitable Bldg., Portland 4, Oregon, or circle number on our card.

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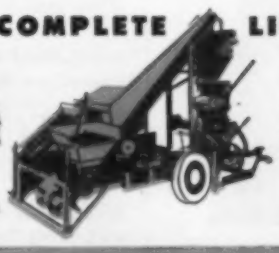

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STREETS AND HIGHWAYS

Fallacies of the "Low Bid"

78. . . . were never better exposed than in this thoughtful new booklet titled "The Best Bid for Your Budget." Reveals the hidden factors that often make the "low bid" the high bid in purchasing motor graders. For your copy of Form E014, write Caterpillar Tractor Co., Peoria, Ill., or check the inquiry card.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Get to do Asphalt Mixing or Patching?

118. Whatever the job, speed and simplify your work with modern Wylie equipment for hot or cold paving materials. As the first step to improved performance get new data from Wylie Mfg. Co., P. O. Box 7086, Oklahoma City 12, Okla., or use the reply card.

The Brush Chipper With Ten Exclusive Advantages

128. Brush chipper features worth investigation are described in Mitts & Merrill Catalog 460. Advantages include ability to cut two sizes of chips. Catalog illustrates uses and gives specifications of "Beaver" Chipper. For your copy, write Mitts & Merrill, 1009 S. Water St., Saginaw, Mich., or check reply card.

Chip Dollars from Your Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

To Sweep a Better Street for Less

162. Find out about what Prostran can do to make your street sweeper brooms last longer, cut "down-time" and lower your cost per sweeping mile. A folder, with sample polypropylene filament is yours for the asking from E. B. & A. C. Whiting Co., Burlington, Vermont.

Compact Wheel Tractor Makes Maintenance Jobs Easy

172. Rugged and powerful yet exceedingly low in cost, the Speedex Model S23 tractor with 9 hp engine will work for you all year around on park and yard maintenance chores. Attachments include gang and rotary mowers, cutter bar, front and rear blades. Check advantages of this versatile machine by writing Speedex Tractor Co., 367 N. Freedom St., Ravena, Ohio.

International Wagner Heavy-Duty Loaders and Backhoes

195. International Wagner loaders and backhoes are matched with International utility tractors and are described in Catalog CK-1076-I available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card.

Gradall Does Too Many Jobs To Classify Them

340. The best way to learn how many places and in how many ways the Gradall earth moving and construction machine can speed work and save money for you is by writing for brochure M-2460. You get it from The Warner & Swasey Co., Const. Equipment Div., 5701 Carnegie Ave., Cleveland 3, Ohio, or by circling above card-number.

Prompt Service on Sweeper Refill Fibers

367. Here's a dependable source of power sweeper refill fibers, including domestic and imported types and gutter broom wire. To get all the data write A. Steiert & Son, Inc., Hatfield, Pa., or use our reply card.

How Warn Hubs Add Convenience to 4-Wheel Drive Vehicles

385. Warn locking hubs add versatility to 4-wheel drive vehicles, make it easy to shift to free-wheeling 2-wheel drive that cuts front end wear, eases handling and steering, reduces gear whine. Warn hub models fit all leading 4-wheel drive trucks. Get Form DC559-5 from Warn Mfg. Co., Inc., Riverton Box 6064-DC, Seattle 88, Wash., by checking reply card.

For Fast Hole-Digging

394. . . . discard old fashioned ideas and tools and look into this new, highly maneuverable hydraulic digger that paces utility, guard rail and similar earth boring operations with amazing speed and economy. Hole diameters to 24", depths to 75 feet. New bulletin D-6 tells how good it is—and why. Address Mobile Drilling, Inc., 960 N. Pennsylvania St., Indianapolis 4, Ind., or use our card.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Levels Sidewalks and Curbs Quickly and Easily

510. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

Keep Communication Right Under Your Hat . . .

567. with this new-type miniature 2-way transistorized radio system. With it you are never out of touch with jobs or personnel. TELEPATH Systems can be worn like clothing. No license required for 27 mc type. Write for literature to SEISCOR, Box 1590, Tulsa, Okla.

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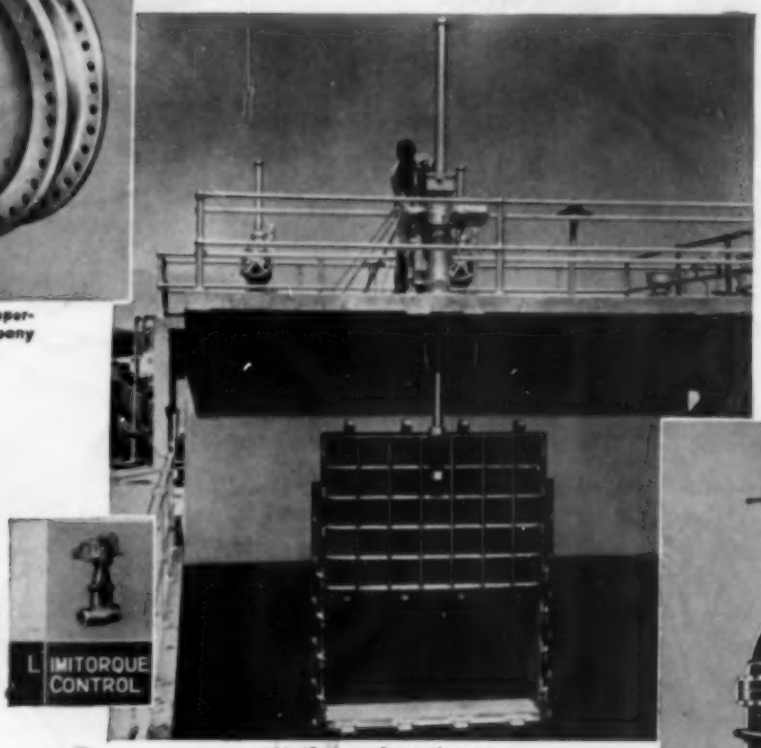

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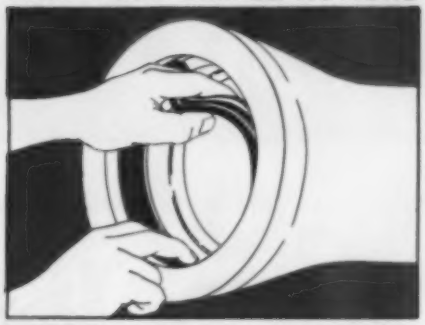
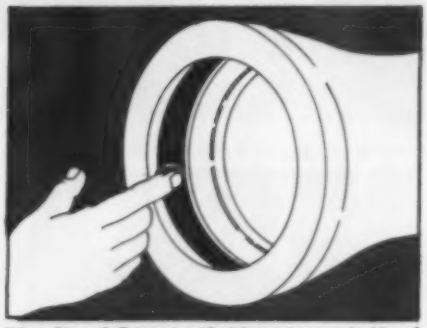
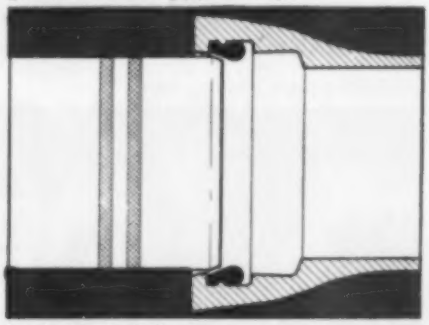


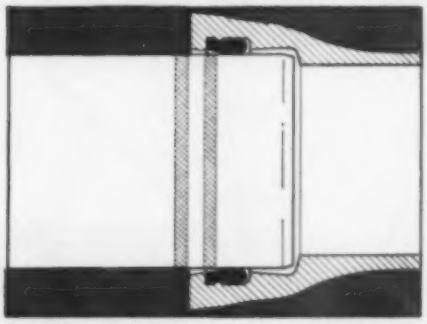
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . . fast, efficiently, economically. Could anything be simpler?

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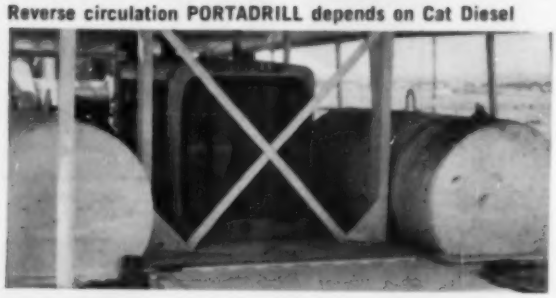

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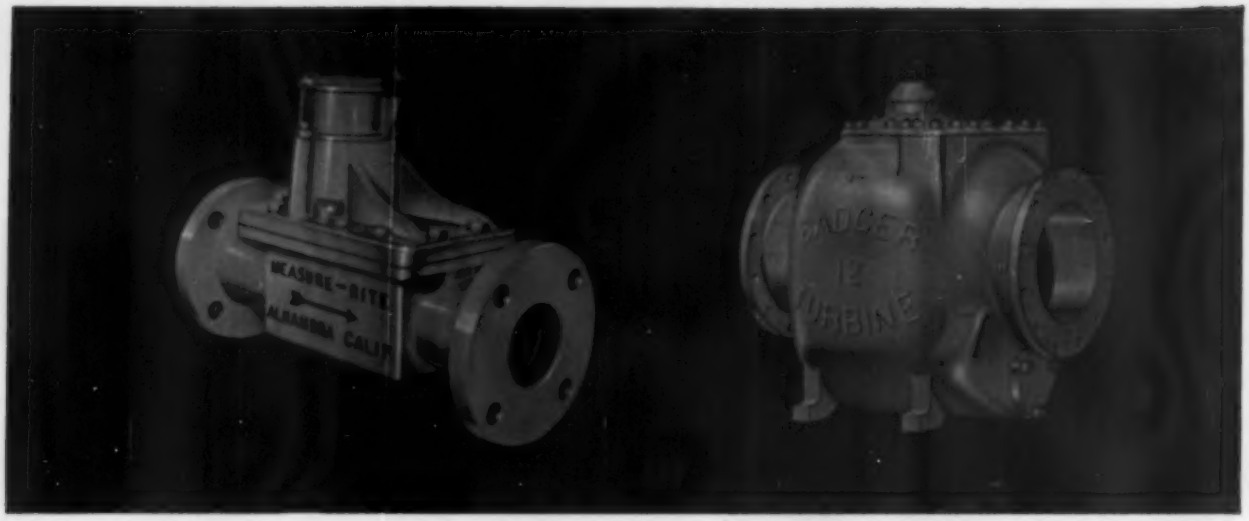

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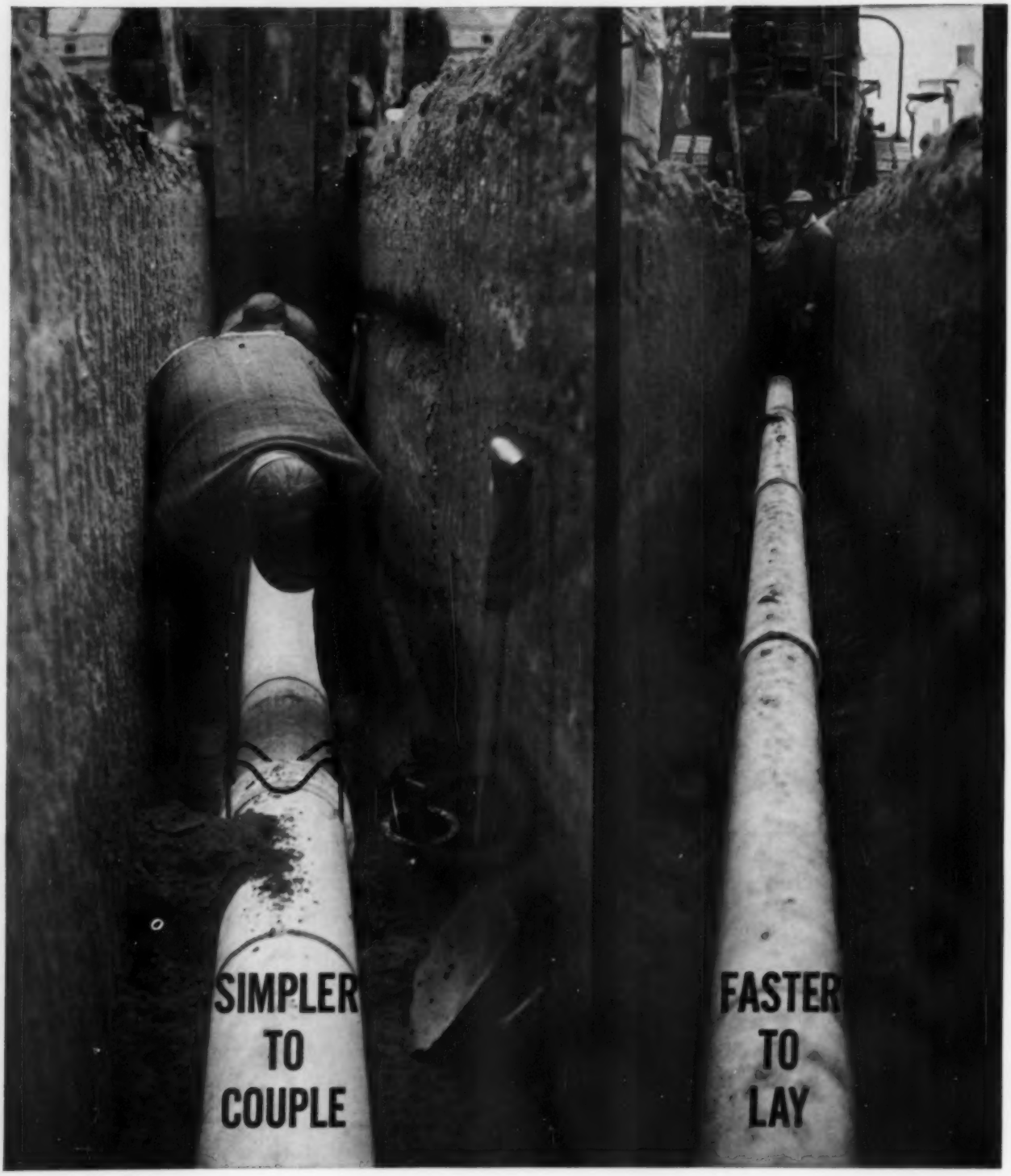

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Ed Cleary Says:

No Water Crisis Unless Of Our Own Making

EDWARD J. CLEARY
Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

EVERYBODY IS talking about water these days. But nothing exceeds in number, scope and profundity the discussions generated by the Senate Select Committee on Water Resources. The committee has been conducting hearings and taking testimony for about a year. Much of this material is now available in published form.

Contrary to the gloom-and-doom predictions that have captured so much attention recently in the public press, the evidence placed before the committee thus far cannot be construed to reveal an impending national water shortage. While deficiencies in quantity of water have asserted themselves in some areas, it appears that the satisfaction of future needs in most places may be accomplished through: 1) Construction of additional storage facilities to retain a larger share of rainfall that now runs unimpeded to the oceans; and 2) extending the usefulness of existing supplies by more vigorous practice of pollution control.

Potentialities of Re-use

The revelations before the committee of continued public apathy—if not resistance—to pollution control makes it evident that the concept of water re-use and its potentialities for satisfying future demands is not too widely appreciated. Among other things, this suggests that the engineering profession must constantly strive to make clear to the public that there is a vast difference between water *use* and water *consumption*. Much confusion about the future outlook for water supply may stem from the erroneous assumption that use and consumption mean the same thing. Industry, for example, is frequently cited as a voracious user of water. True, industrial activity does use a lot of water. But it *consumes only about 2 percent of what it uses*, the remainder being returned—more or less soiled—to the source for re-use. A similar condition prevails with regard to municipal water use; only about 10 percent is actually consumed.

The point is that when something is soiled it need not be irrevocably lost to use. As one witness before the committee put it: You don't throw away your shirt after it has been worn. You simply have it laundered for re-use. In the same fashion, must not we look upon water that has been used by a municipality or industry as being lost entirely. It can be "laundered" and thus be made available for re-use over and over again.

Quality Rather than Quantity Problems

It would not be surprising, therefore, if the Senate Select Committee should conclude that problems in preserving the quality of water resources for re-use presently overshadow those relating to quantity. And this in turn compels attention to: 1) The availability

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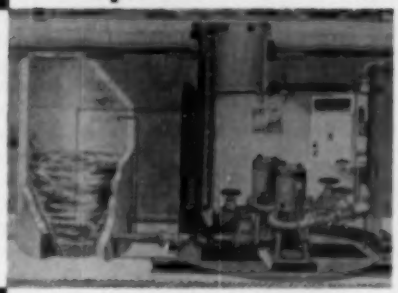

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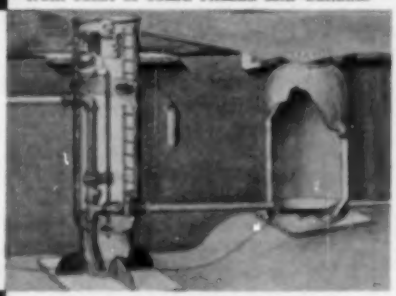

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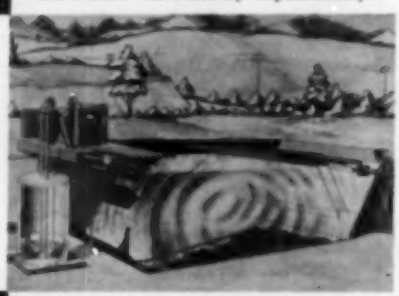

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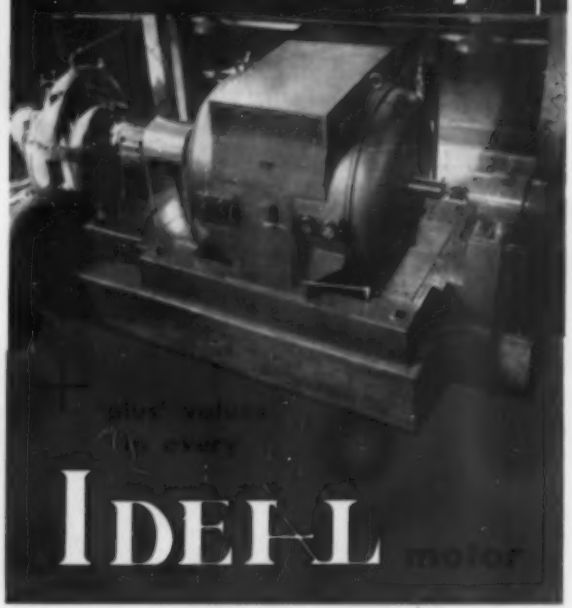

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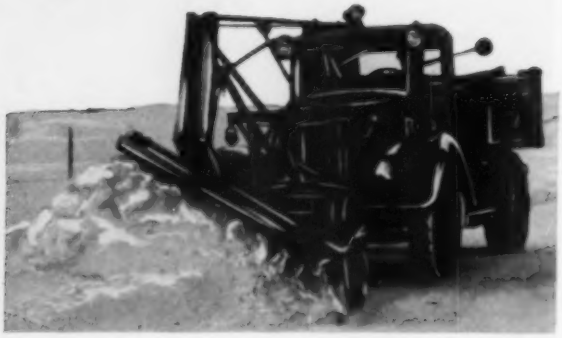

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and adequacy of "laundry service" for cleansing used water; and 2) how effectively it is being applied.

Such an inquiry would reveal, among other things, that the sanitary-engineering profession is not lacking in either numbers or skills to design these services. Equally prepared to meet the needs are the manufacturers who have devised many specialized pieces of equipment for purification of municipal and industrial waste-waters. From a technological standpoint, at least, we are well-advanced in the art of cleansing used water. Of course, there are opportunities through research for improving practice; but this does not suggest that progress in water-pollution control must be paced to research effort.

If it is conceded that we already possess the know-how for pollution control, why then is it not being applied more effectively for conservation of water resources? Fundamentally, it is because people—as members of a community or a corporate enterprise—have not yet been sufficiently motivated to recognize their social responsibility for keeping clean what they have been privileged to borrow and use.

Need for Public Motivation

Laws prohibiting pollution have provided some motivation. In other places the potentiality of health hazards has provoked action. And in a few areas people have been inspired by eloquent leaders to do their duty. But the dismal record of municipalities and industries who continue to despoil the streams of this nation to the detriment of their downstream neighbors suggests that a large segment of the American people have yet to feel a sense of obligation for the protection of water resources.

It seems incredible that one of the largest organizations in this country devoted to the advancement of municipal administration could find reason to bestow its accolade of "All-American City" on a community that has had a woeful record of delinquency with regard to sewage treatment. Yet this actually happened within the past year!

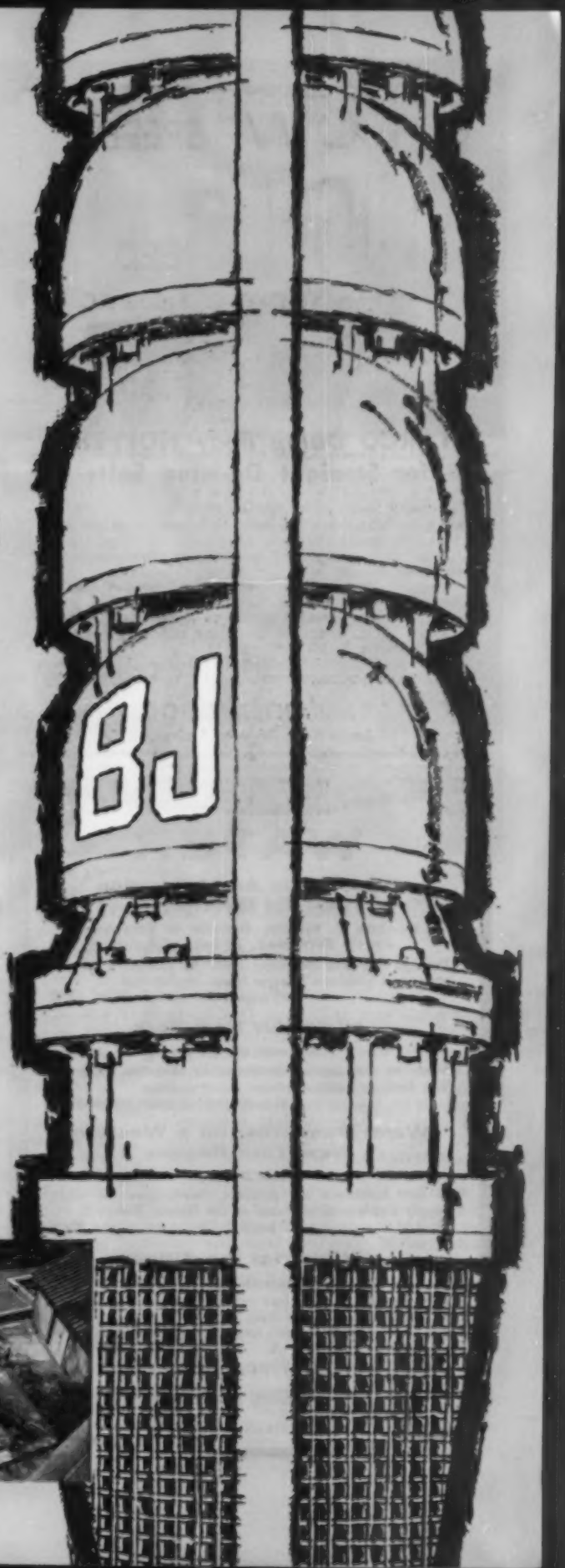
And there is the recent example where new oil field operations in the upper reaches of a Midwest river have been saturating the stream with so much waste brine that it has become virtually useless as a source of municipal or industrial water supply. It is ironical that these things are happening at the very time the nation is pondering what to do about the future problems of meeting water demands. Obviously, the exercise of some discipline in the preservation of existing supplies is a logical starting point.

Call from the White House

The decision to hold a White House Conference on Water Pollution, which is to be convened in December, is a manifestation of the need for motivation from high places. In the words of President Eisenhower: "The conference is intended to provide a forum in which all concerned can confront and better appreciate their mutual responsibilities for solving this pressing problem". It is expected that this meeting will bring together some 1200 people who will be asked to: a) Assess the status of water pollution control; b) pinpoint the barriers presently standing in the way of progress; and c) reach agreement where possible on means and methods of advancing remedial action.

This conference, coupled with the evidence being assembled by the Senate Select Committee, can dramatize what sanitary engineers have sought to preach—namely, keeping streams clean offers one of

Quality *costs less* in the long run!



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the most productive means for safeguarding our water supplies. The prestige of the committee and the competence of those who are providing testimony offer hope that the American people will find ample justification for a more positive attitude toward the abatement of water pollution. In so doing they may take comfort in the knowledge that they are doing their part in minimizing the possibilities of a shortage of good water. But as one witness profoundly observed: "We face no crisis unless it is of our own making".

Sewage Pumping at Los Angeles Airport

The sewage pumping plant currently in operation at the Los Angeles International airport is located between two main runways. This has long been a hazard to operators and maintenance men who must cross a runway to reach the plant.

A new pumping plant will be located north of the runways and taxiway and be accessible to operating personnel without crossing runways or taxiways. The entire structure will be below ground level with the exception of ventilating pipes, handrails and fences, all limited to six feet above ground level. The pumps will run at variable speeds through the use of magnetic couplings designed to vary the speed in accordance with the depth of the flow in the influent channel. This design will permit sewage to be discharged at the same rate at which it is received. The capacity of the plant will be increased to handle a storm water flow of 1800 gallons per minute using two of the three torque flow pumps to be installed. The pumps will be driven by three direct coupled 30 horse power electric motors.

Getting Ready for Handling Disaster Problems

A "disaster city" is being opened in Pasadena, Calif., according to *Public Health Reports*. This can be used as an emergency civil defense or alternate local government headquarters. The main building contains a large auditorium, office space, classrooms, a modern kitchen and nurses' quarters. An estimated 10,000 refugees could be housed in tents on the grounds and fed from the kitchen facilities

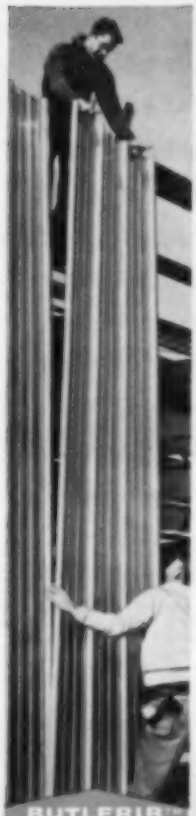
A "disaster street" is also under construction to be used as a training area for civil defense personnel and for testing rescue, monitoring and first-aid conditions.

The installation will serve also as full-time police academy and will be available to the public for selected civic projects.

Values Recovered from Sludge Gas

During 19 years of operation, the records of the Gary, Indiana, activated sludge sewage treatment plant show the value of sludge gas recovered over that time has amounted to $418,379.90, or $60.29 per day. Over the past few years, gas production appears to be decreasing gradually. Consideration is being given to increasing circulation in the digesters. The average gas production was 0.96 cu. ft. per capita per day and an average of 1.7 cu. ft. per pound of solids added or 3.4 cu. ft. per pound of volatile solids added.

W. W. Mathews is plant superintendent and the above data are from his excellent and interesting report for 1959.



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USS AmBridge Highway Beam Guard rail and Posts help safeguard traffic. This rugged, flexible steel beam guard rail is highly visible. It bolts easily but firmly to steel posts and is available in 12'6" and 25' lengths to minimize splicing.

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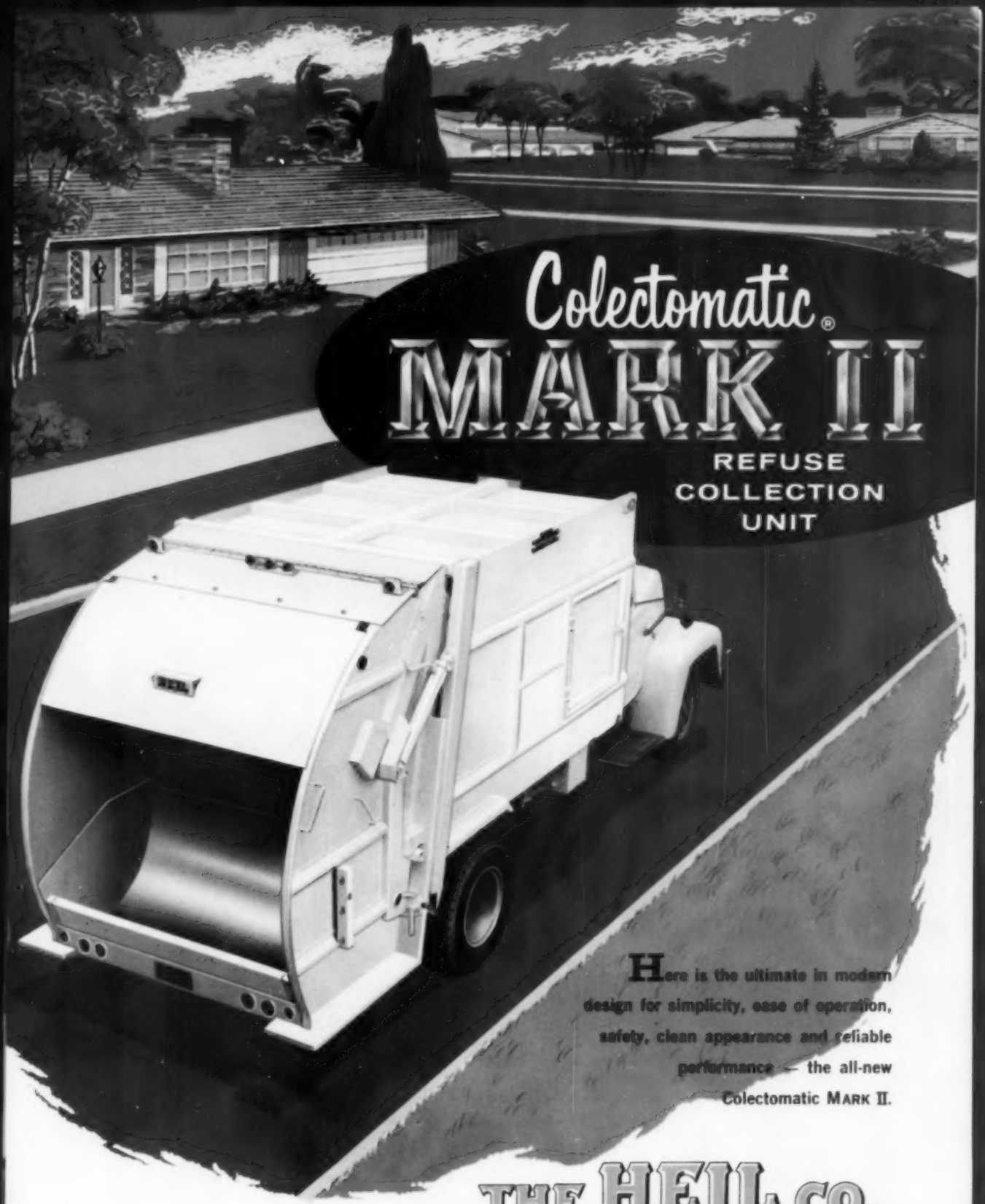


Colectomatic® MARK II

REFUSE COLLECTION UNIT

Here is the ultimate in modern design for simplicity, ease of operation, safety, clean appearance and reliable performance — the all-new Colectomatic MARK II.

THE HEIL CO.

MILWAUKEE 1, WISCONSIN

BULLETIN BH-60106

this is the Colectomatic®

13, 16 and 20 cu yd capacities

BEST FOR THE ROUTE...

The MARK II loads more refuse each trip — and high-pressure, "Duo-Press" compaction can be used to put a powerful, two-way squeeze on each hopperful as it enters the body. This exclusive action compresses each load between the packer plate and the ejection panel until the body is full. Electronic pushbutton operation . . . low, wide loading sill . . . large hopper . . . complete freedom from jamming — all these advanced features add up to the fastest, most efficient refuse collection unit you've ever seen.

BEST AT THE DISPOSAL POINT...

Raise the tailgate, flip the controls, and the MARK II's ejection plate bulldozes the entire load out of the body in seconds. Positive ejection empties the unit completely without destructive shaking and jerking to loosen compressed material. Raised-body dumping is eliminated so there's no tendency for front wheels to leave the ground. Tailgate stays high, clear of refuse. Discharging at incinerators, clearance is no problem because the body stays down, out of the way of ceiling and doors.

BEST IN THE SHOP...

Maintenance of the MARK II couldn't be easier. Solenoid-controlled, pilot-operated hydraulic valves automatically coordinate each phase of the working cycle, keep the unit in perfect adjustment at all times. Lubrication and inspection of all components is simplified for speedy routine maintenance procedures.

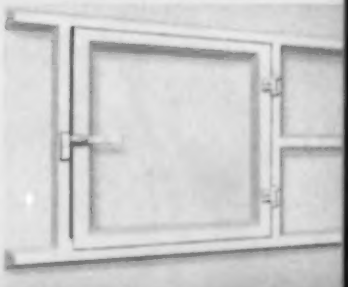
BEST WHEN YOU BUY...

You save two important ways when you buy the Colectomatic MARK II. The unit can be matched properly with a truck chosen on the basis of load-bearing capacity. There's no need to consider front end weight to hold wheels on the ground during dumping. What's more, "Duo-Press" packing action provides greater compaction of compressible refuse, which often means you can purchase a *smaller* model to haul a given payload— or *fewer* units to handle a given collection schedule.

EJECTION CONTROLS are placed conveniently at left front of body. Operator can eject entire load swiftly, safely, completely — return to collection route minutes faster than ordinary dumping methods permit.

THESE OPTIONAL FEATURES MATCH THE MARK II TO YOUR NEEDS

EXTRA SIDE LOADING DOOR, identical to standard door on curb side, permits loading from left side for convenience in alleys or one-way streets.



MARK II

LOW CLEARANCE HEIGHT eliminates trouble with low entryways at incinerator or garage. Even on 20-cu-yd models, average height of body above truck frame is less than 7 ft. — low enough to clear overhead structures and tree limbs likely to be encountered on typical municipal collection routes.

CLEARANCE LIGHTS AND REFLECTORS are furnished as standard equipment, fully meet latest I.C.C. standards.

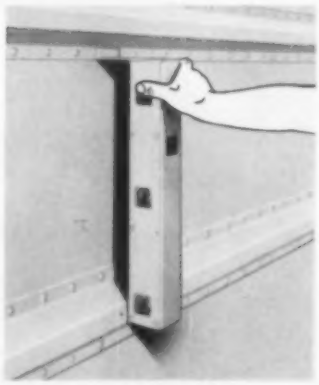
LOW, WIDE HOPPER SILL provides for easy loading. Standard height is 9 ft. above top of truck frame, may be mounted higher for special conditions. Huge opening easily accepts bulky refuse — including big drums or discarded furniture.

SAFE PACKING OPERATION protects crews. Exclusive packing action raises hopper sill to loading level before packer plate moves down. Careless operators can't get caught between packer plate and hopper.

INSIDE
load e
to eje
point

PUSHBUTTON ELECTRONIC CONTROL

The entire packing cycle of the MARK II is pushbutton-controlled through electric solenoids, which in turn control pilot-operated valves in the hydraulic system. Packing operation may be stopped instantly with the safety stop-button, or reversed during any part of the cycle. Pushbuttons located at both sides of the loading opening give operators complete control of packing cycle. Safe, simple pushbutton operation speeds collection, reduces operator fatigue, eliminates expensive downtime for maintenance and adjustment.



MARK II

TAILGATE AND PACKING MECHANISM are raised to expose big, wide opening during ejection cycle, can't interfere with discharge.

WATERPROOF SEAL prevents liquids from leaking out of the load. Side and bottom closure of the tailgate is sealed, liquid can't drip out or into hopper.

POSITIVE EJECTION of tightly packed load sweeps entire body clean in seconds. With tailgate raised, powerful ejection plate bulldozes load of refuse out rear of body.

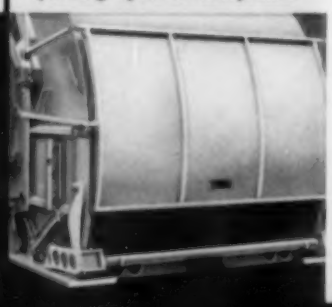
STABILITY AND BALANCE assured under all conditions. New dumping design permits ideal distribution of weight, so front wheels stay firmly on ground.

INSIDE CAB CONTROLS for load ejection permit driver to eject load at disposal point without leaving cab.

HYDRAULIC CONTAINER DUMPING MECHANISM picks up, empties, deposits all standard 1-cu-yd containers. Exclusive design allows pick-up without close "spotting." Latch and dump mechanism is controlled by pushbutton.

REFUSE COLLECTION CONTAINERS are 1-cu-yd in capacity. Hinged lids close container securely. Two fixed, two swivel wheels make maneuvering easy. Sturdily made of welded steel with attractive, sanitary-looking white finish.

AUTOMATIC REAR SAFETY DOOR lowers to cover loading opening and remains down during most of packing cycle. Door automatically opens as packing cycle is completed.



FAST, SAFE LOADING CYCLE *SPEEDS COLLECTION*

1

When hopper is full, operator pushes button to start loading cycle. Packer plate automatically moves back and upward as hopper rises. Safety door (optional) covers load opening.

2

Packer plate meets hopper at top position, starts to bulldoze refuse forward into body with rolling action that wipes hopper clean.

3

When packer plate reaches forward position in packing cycle, hopper returns to loading position. Safety door automatically moves up.

4

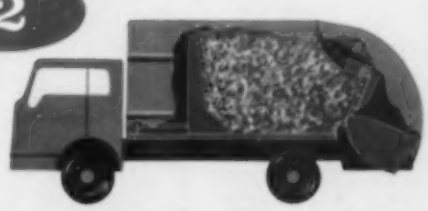
Hopper in loading position, the **MARK II** is ready for another load. Packer plate remains in forward position, holding refuse securely in body. Entire cycle is complete in 12 seconds!

REVOLUTIONARY "Duo-Press" COMPACTION OFFERS *BIGGER LOADS*

1

At start of collection route, ejection plate can be positioned at rear of body. Packer plate then forces first loads against ejection plate.

2

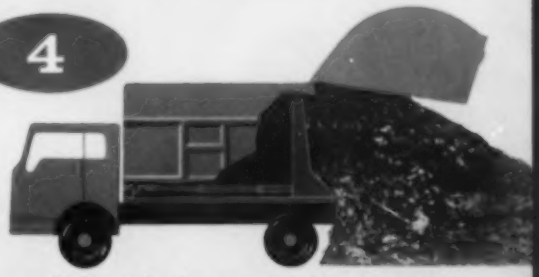


Compaction continues with each loading cycle, squeezing material between packer plate and ejection plate, until hydraulic relief valve allows ejection plate to move forward in body.

3

With body completely full, entire load is uniformly compacted between packer and ejection plates. "Duo-Press" compaction from first to final loads assures full capacity each trip.

4



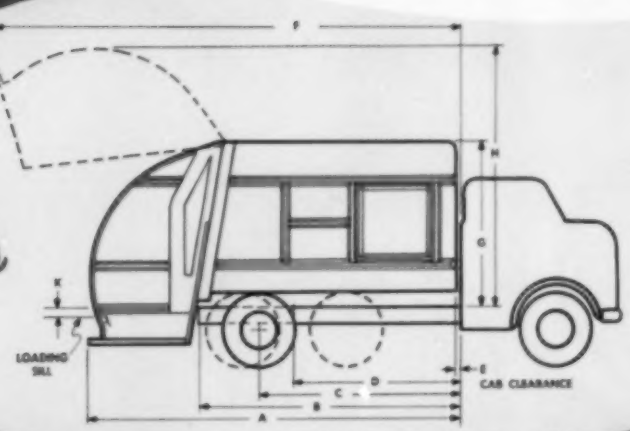
At disposal point, operator simply raises tailgate, flips ejection control—and ejection plate pushes tightly compacted load out of body.

Colectomatic® MARK II

specifications

BODY	Interior	smooth floor and sides, no obstructions
	Side loading door	35 in. x 36 in.; curb side standard, street side optional
	Maximum outside width	95¾ in.
UNLOADING MECHANISM	Ejection panel	vertically mounted; ejects load without raising body; double-acting hydraulic cylinder actuates panel
TAILGATE AND HOPPER	Hopper capacity	1½ cu yd
	Loading height	5 in. below top of frame
	Cycle time	12 seconds (normal)
	Load opening height	54 in.
	Load opening width	80 in.
CONTROLS	Packing cycle	pushbutton electronic control of hydraulic valves for packing mechanism; pushbutton signal buzzer
	Location	
	Packer controls	at rear, both sides of load opening
	Buzzer control	on panel with packer control
	Ejection control	left front of body; includes remote throttle control; optional location inside cab
	PTO control	inside cab
LIGHTS REFLECTORS		standard I.C.C., 12-volt
		standard I.C.C.
OPTIONAL FEATURES	Safety door	automatic operation during packing cycle; mechanically actuated
	Container mechanism	pushbutton-controlled, powered by twin hydraulic cylinders; handles all standard refuse containers
	Refuse containers	
	Length overall	77¼ in.
	Width outside	29¾ in.
	Height from ground	45½ in.
	Capacity	1 cu yd (21 bushels)
	Casters	2 rigid, 2 swivel wheels; 6-in. diameter x 2-in. width; rubber tires and roller bearings

dimensions



	13 cu yd	16 cu yd	20 cu yd
A—Length, cab to rear	172¼ in.		
B—Length, cab to end of body			
C—Cab-to-axle, single axle truck			
C—Cab-to-axle, tandem axle truck			
D—Cab clearance			
E—Length, cab to rear, tailgate raised			
F—Body height above truck frame			
G—Body height, tailgate raised			
H—Truck frame to loading sill			
Body width			
Approximate weight			

The company reserves the right to make its product improvements policy to change construction or design details and furnish equipment when so altered without reference to illustrations or specifications used herein.

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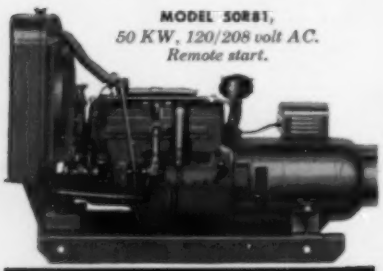

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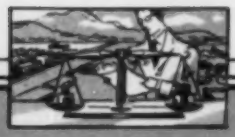

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Municipal Exemption from Tort Liability

Closely related in principle to the case of McAndrew v. Mularchuk, discussed above, is the case of *Toppi v. Arbour*, 119 So. 2d 621, a Louisiana case decided March 21, 1960.

This was an action for injuries sustained by a pedestrian when she fell on a defective brick sidewalk. The action was brought against the municipality and against the abutting landowner. Liability of the landowner was predicated on a statute which allegedly shifted the responsibility for maintaining sidewalks to the abutting property owner.

The court held, however, that this statute did not have the effect of exempting the municipality from liability for negligence in maintaining the sidewalk, and merely shifted the financial burden of paying for the cost of sidewalk maintenance and repair to the landowner.

The municipality argued that the legislature cannot waive governmental immunity from tort liability and, hence, neither can the courts.

The court pointed out, however, that the immunity of a municipal corporation is not, in Louisiana, based on any constitutional (and hence "unwaivable") provision, but is a judicially-created doctrine. The tort liability of municipalities for damages resulting from the failure to keep streets and sidewalks in a reasonably safe condition for travel has traditionally not been subject to the defense of governmental immunity. Consequently, the court narrowly construed the statute mentioned above, so as not to expand the immunity further.

Municipal Immunity for Tort Liability

McAndrew v. Mularchuk, a New Jersey case decided June 28, 1960, is important because it reverses, in part, the most basic law as to the liability of a municipality for a tort committed by it.

Under this rule, a municipality is (with some exceptions) immune from liability for torts committed by it in its governmental capacity (as distinguished from its proprietary capacity). The New Jersey Supreme Court has now held, however, that a municipality is liable for injurious acts performed in its governmental capacity, provided they constitute *active wrongdoing*, that is, negligent acts of *commission* rather than of omission.

In this case, a boy was wounded when a reserve policeman fired a warning shot at him as he was trying to escape, accidentally hitting the boy. The policeman did not intend to shoot the boy, but hit him as a result of his inexperience with the gun.

The court held that the municipality was negligent in allowing the reserve officer to go out on patrol without sufficient training and experience in the use of a gun.

The municipality argued that it was improper for the court to change the law in this way,—that such a serious change in the law should be made by the legislature instead of by the court. The New Jersey Supreme Court, however, rejected this contention, saying that this restriction on liability was invented in the first place by the courts, and that it was outmoded, inequitable and artificial, and should be corrected by the court.

This will of course have strong repercussions in New Jersey, and probably will eventually spread to other jurisdictions as well.

The Conventional Rule

On the other hand, the conventional view of the rule relating to municipal immunity from liability for the torts of its officers committed in a governmental activity

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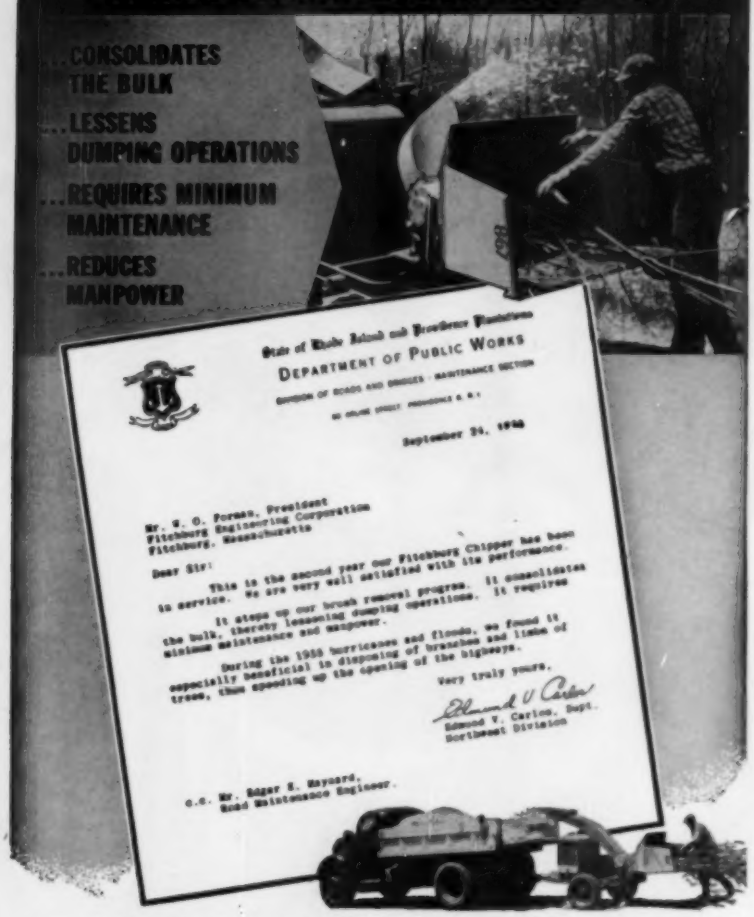
State of Rhode Island and Providence Plantations
DEPARTMENT OF PUBLIC WORKS
September 24, 1958
Mr. G. O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts
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Very truly yours,
Edmund V. Carlos, Dept.
Northeast Division
c.c. Mr. Roger S. Hayward,
Road Maintenance Engineer

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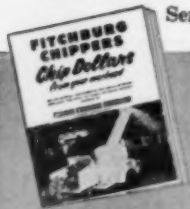

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is illustrated in the case of *O'Connor v. City of Minneapolis*, 182 Fed. Supp. 494, a case decided in the U. S. District Court in Minnesota on April 1, 1960.

This was an action against the city to recover damages arising from plaintiff's illegal arrest and false imprisonment by police officers of the City of Minneapolis.

The court denied the relief, citing many cases to show the common law doctrine of immunity of municipal corporations for the wrongful acts of their police officers in making arrests or detaining prisoners.

• • •

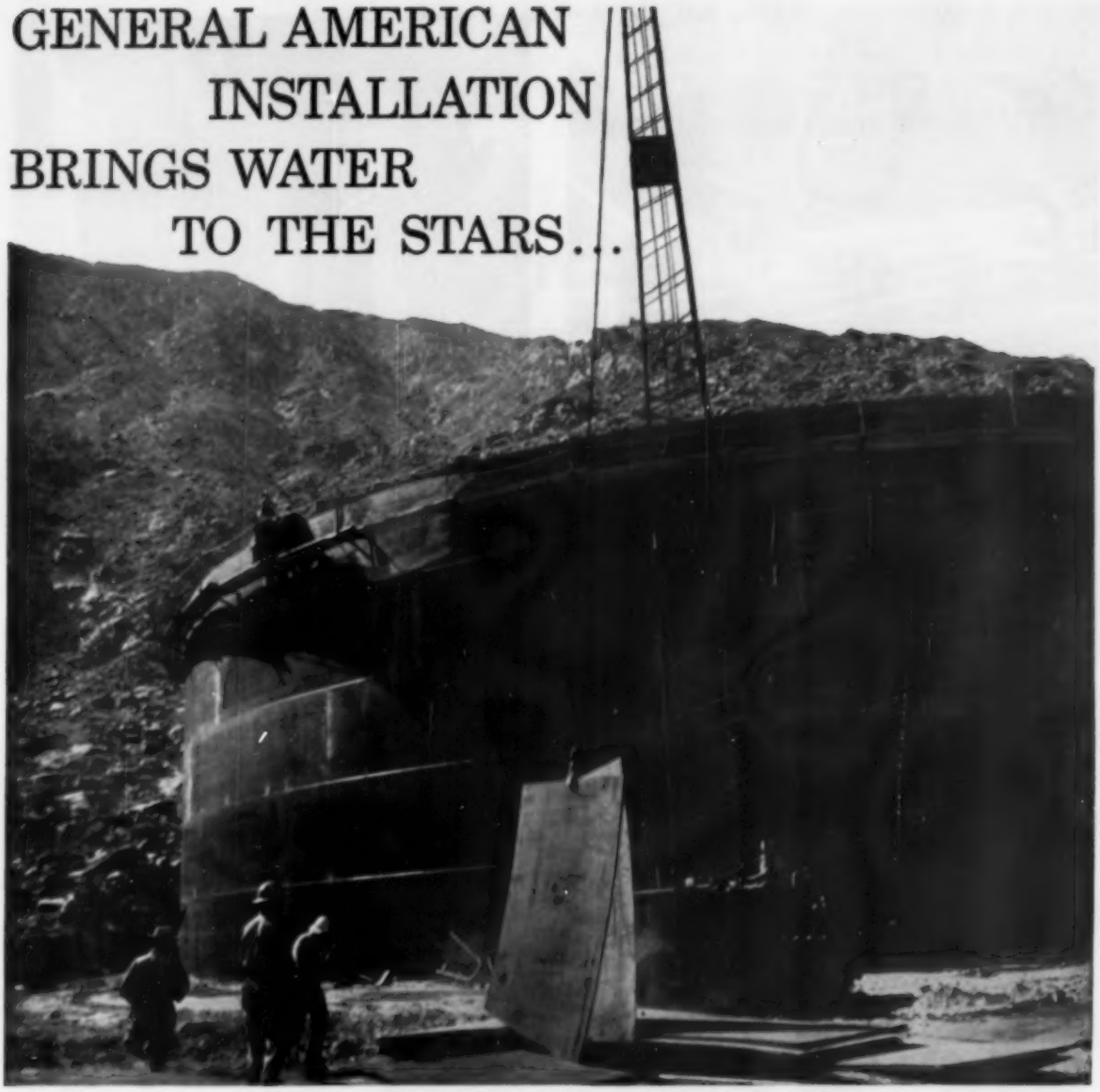
Detergent Research in England

With the aim of solving the public health problems caused by the use of synthetic detergents, tests with detergents containing a new "soft" form of surface active agent have been carried out in Great Britain. First results show that household washing powders, containing the new surfactant developed by the manufacturers, are more easily decomposed by bacterial action. Following promising results from pilot plant investigations made at the Water Pollution Research Laboratory, in August 1958 the manufacturers started to supply the Luton area, through normal trade channels, with the substitute detergents. Similar in every other way to the usual proprietary brands, these were packed in standard cartons to avoid altering buying habits. By the end of 1959, 70 percent of the powder used in the area was of the new type. The removal of surface-active matter during treatment of the town's sewage at the Luton works was observed. The results confirmed the pilot-scale trials. Distribution of the detergent on a larger scale in the South of England is planned for continuation of the tests.

Diesel-Electric Power for Construction

The major portion of the construction power for the $52,000,000 Oroville-Wyandotte Irrigation District project is being provided by five 750-kilowatt portable diesel generator sets furnished by A. G. Schoonmaker Co. These units will be employed in the 2½-year project stretching some forty miles back of Oroville and along the south fork of the Feather River, entailing a complex of earth and concrete dams, tunnels linking mountain canyons and canals.

GENERAL AMERICAN INSTALLATION BRINGS WATER TO THE STARS...



Palm Springs is a thirsty city. In this desert playground of movie stars and sun-worshippers at the foot of water-rich Mt. San Jacinto are more gardens and swimming pools per capita than any other place in the world. Within the mountain are many underground streams. The problem was to tap the resources and store more water than existing reservoirs would hold. The answer—a 5,000,000 gallon tank fabricated in General American's shops, trucked to a hard-to-reach spot on the hillside and erected by a General American field crew.

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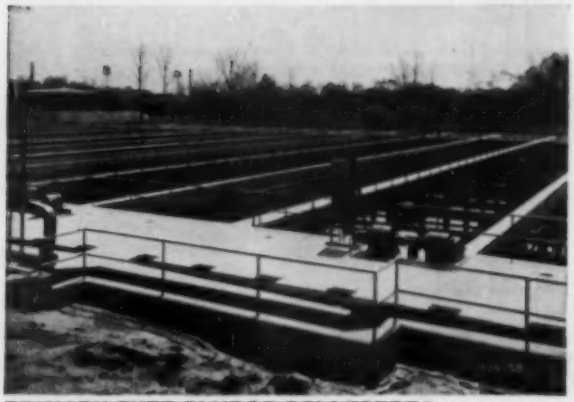

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PUBLIC WORKS MAGAZINE

Water District Has Three Sources of Supply . . . BUT ONE IS AWFUL!

GENE A. CLAUSSEN
Head, Utilities Section,
Ken R. White Consulting Engineers, Inc.,
Denver, Colorado

THE BAKER Metropolitan Water and Sanitation District, located immediately north of the Denver city limits, is facing a problem which is becoming more common daily — that of poor raw water quality caused by contamination of the source by waste water from cities and districts immediately upstream.

The District embraces approximately 2,000 acres and the present population is estimated at 13,500. Water users within the District consist, for the most part, of residences with some businesses and one major industry.

The latter part of 1958 saw consumer complaints and public protest meetings reach an all-time high. Taste, odor and foaming were the main objections; however, a group of unsafe samples found by the State Health Department did not help the situation. (These may have been caused by manganese infiltration resulting in false readings of chlorine residual.) The adverse publicity caused concern to all, and the growth of the District was impaired.

The situation resulted in the decision of the Board of Directors of the Baker District to seek outside consultation and in January, 1959, it authorized a water supply and treatment study to be prepared by Ken R. White Consulting Engineers, Inc., of Denver. The study was separated into two phases. Phase "A" was the preparation of a comprehensive engineering report due the following April. Phase "B" consisted of a continuing program of investigation of the raw water and treatment results with periodic determinations of the performance of the water treatment plant for one year after the completion of Phase "A".

Existing Supply

The investigation revealed that there were three water sources: Denver water, surface water from Clear Creek and deep well water.

The water purchased from the Denver Water Board is of excellent quality but the contract between the District and Denver restricts its use to the original District boundaries which cover about 720 acres, with a population of 2,200.

The District expanded its boundaries in 1955 and in subsequent years by the inclusion of various newly constructed subdivisions. This made it necessary to seek new sources of supply for the new area. The District consequently entered into an agreement with William Jay Construction Company to purchase water rights out of the Kershaw Ditch which diverts from the north bank of Clear Creek. Another agreement with the same firm provided for the purchase of a newly constructed 1.5 mgd water treatment plant to prepare this source for consumption.

The plant was later expanded to 3 mgd. It is well designed (although manually operated) and employs

● **BEFORE changes were made, foam at the raw water aeration basins reached the height of the man's hand. Spray nozzles on railing and trough at right which discharges to waste have reduced the foam problems, but the plant is still required to treat a highly contaminated water supply, which it does with excellent results.**

accepted water treatment methods. The major components are as follows:

1) An earthen raw water storage reservoir providing 37 hours detention at design flow.

2) A concrete aeration basin providing 20 minutes detention at design flow.

3) Two concrete-pre-treatment basins consisting of a flocculation zone with a detention time of 20 minutes and a clarification zone with a detention time of 60 minutes.

4) Four rapid sand filters.

5) A 9000-gallon clear well.

6) Chlorination facilities with provisions for both pre and post-chlorination.

7) A 350,000-gallon steel clear water storage reservoir.

8) A 50,000-gallon steel wash water storage reservoir.

9) An earthen decanting pond for waste wash water.

The amount of the surface water available to the plant from the Kershaw Ditch is sufficient for an approximate population of 8900 at peak flows.

Two 750-foot wells were constructed in the latter part of 1958 to supplement the surface supply and to provide a relatively inexpensive source. The wells supply from 150 gpm to 175 gpm each. The water is very soft and of excellent quality. It requires no treatment other than chlorination and is pumped directly into the mains and clear water reservoirs.

Water from the Kershaw Ditch, which goes to the water treatment plant, is contaminated by raw sewage, sewage treatment plant effluent, and occasional mine discharge wastes. Seven sewage treatment plants discharge effluent into Clear Creek above the ditch intake, six within 9 miles and three within 8500 feet of the intake. From the point of diversion on Clear Creek to the water treatment plant, the Kershaw Ditch is slightly over two miles long. Visual examinations along the ditch revealed evidences of trash and raw sewage floating in the water.

The results of tests made on samples of the raw water taken from this source in February and March of 1959 indicated 24-hour composite BOD as high as 21.6 mg/L. The bacterial tests showed a MPN of coliform of from 130,000 to 160,000 per 100 ml. Colorado statutes limit the coliform to 100,000 per 100 ml in sewage effluent. Thus the coliform count of the Kershaw Ditch raw water supply far exceeded that which would normally be the maximum count in effluent discharging directly from a sewage treatment plant.

Possible chemical pollution was investigated but was not found to be serious, at least, during the test period. The Colorado State Health Department had inspected all mines adjacent to or near Clear Creek. It was found that a settling pond containing manganese had broken and flowed into Clear Creek causing an excessive concentration of manganese for a short period of time. It was also determined that small amounts of arsenic and manganese were present in the water seeping and draining from inactive mines above Idaho Springs; however, these amounts were not considered excessive.

Further testing revealed that the important chemical and physical characteristics of the raw water included iron (1.2 mg/L); manganese (0.4 mg/L); phenols (0.003 mg/L); total solids (820 mg/L); and detergents (from 1.2 to 2.8 mg/L).

It is apparent from the results of the tests that many of the above conditions and combinations of the constituents could cause tastes and odors. The tests were taken during the worst conditions, or nearly so, since the flow in Clear Creek was very low. The quality of the Kershaw Ditch water varies considerably with the season. The months from September through April produce the worst conditions because there is very little dilution of the sewage effluent from the various treatment plants. In the months of November through March practically all of the flow in Clear Creek above the Kershaw Ditch intake is diverted leaving mostly sewage effluent to constitute the flow past the intake.

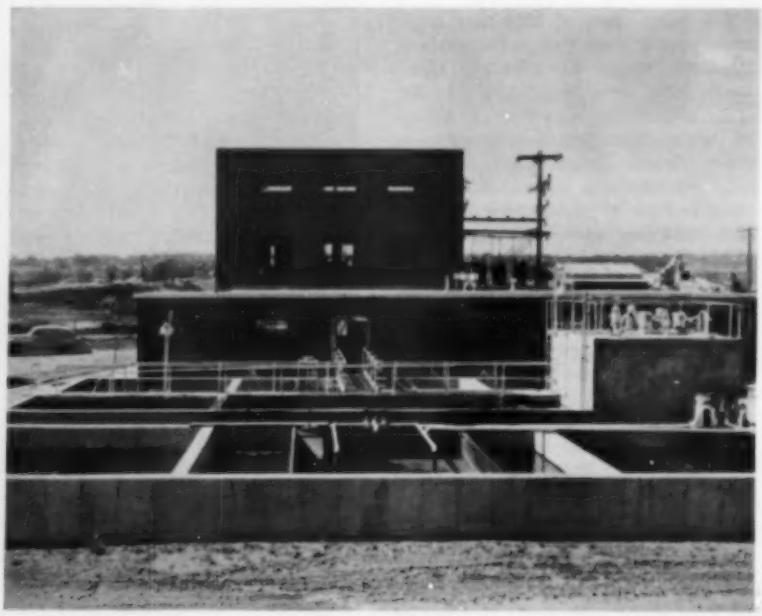
The conditions through the remaining months, May through August, are much improved because of the surface runoff from snow and rain. The water quality improves in practically all respects: tastes and odors subside, detergent content lessens, and sewage pollution recedes. Fortunately the peak water consumption occurs during these months.

Test Runs

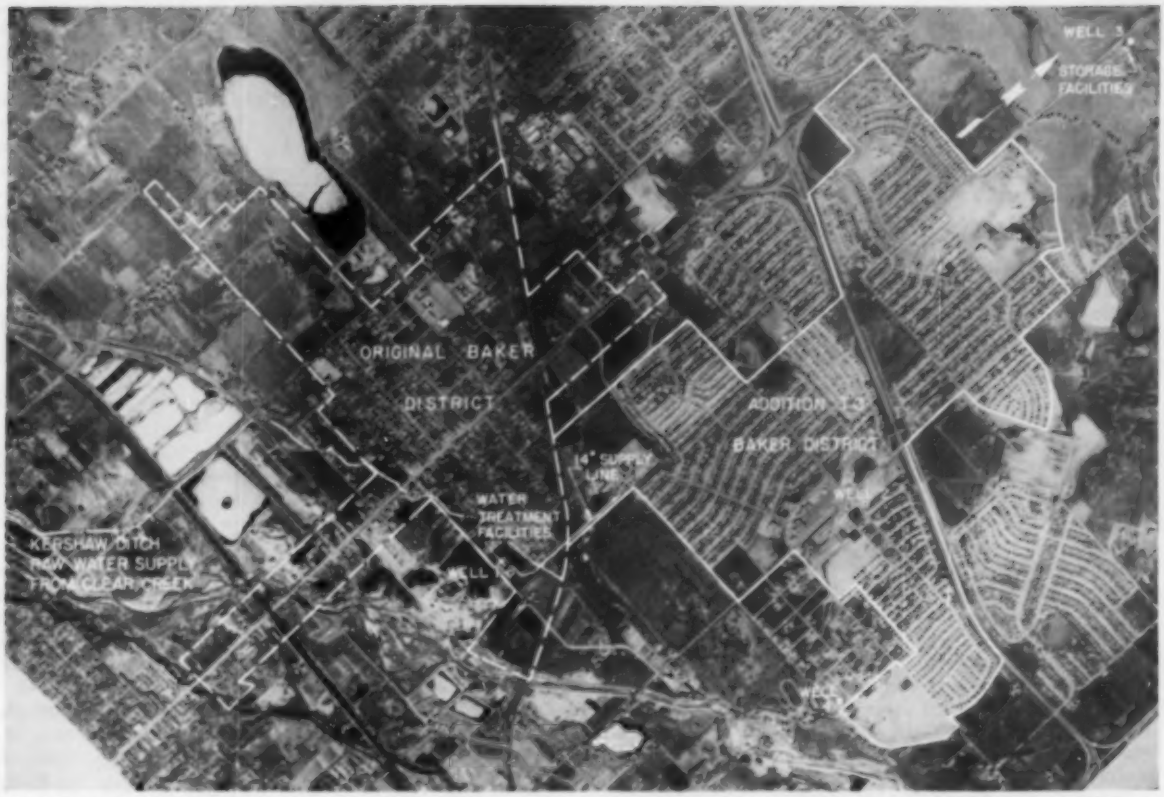
In order to determine conclusively the efficiency of the plant, a bypass pipe line was constructed enabling treated water to be pumped back into the raw water storage reservoir. The plant was then operated under the supervision of the consulting engineers through a series of runs in which the test conditions were varied and the results recorded. This was accomplished in the early part of March when the raw water quality was at its worst. The two wells existing at that time were used to supply the area not on Denver water.

Specific conclusions reached from the test run results were as follows:

1) *Activated Carbon.* Activated carbon applied to the pre-aeration basin removed almost one-half of the synthetic detergents present in the raw water; however, slightly



● **TREATMENT plant of the Baker Metropolitan Water and Sanitation District. Removal of tastes, odors and synthetic detergents is the most dificult problem.**



● **AERIAL PHOTOGRAPH shows comparative extents of the original Baker district and the large addition to the district.**

more floc than normal appeared to pass over the clarifier weirs and onto the filters. This increased the necessity for backwashing the filters but this problem is considered minor.

2) *P-2 Clay.* P-2 clay applied to the pre-aeration basin in lieu of activated carbon removed only about 20 per cent of the synthetic detergents in the raw water. The passage of floc over the clarifier weirs was somewhat less than when activated carbon was being utilized.

3) *Chlorine Dioxide and Activated Carbon.* Chlorine dioxide utilized in conjunction with activated carbon produced the best water as regards taste and odor; however, it was determined that these should not be applied at the same point as one reduces the effectiveness of the other.

4) *Unsafe Samples.* A few unsafe samples were produced, during the testing; however, the cause was found to be the lack of retention time with chlorine dioxide or chlorine. It was determined that this could be overcome by utilizing the 350,000-gallon reservoir for retention during normal operation. It was impossible to do this during the tests.

5) *Alum and Lime.* Alum and lime were used in all of the test runs for coagulation because of their availability. Coagulation appeared to be effective, although it appeared desirable to experiment with other chemicals at a later date and compare the results.

6) *Using Ditch Water.* In order to test the plant under extreme conditions, raw water was admitted directly from the Kershaw Ditch, bypassing the raw water storage pond. Good results were obtained but more chemicals were required. The value of the reservoir with regard to treatment was thereby enhanced; however, it appeared that the efficiency of the reservoir could be improved by changing the location of the inlet to prevent short circuiting.

7) *General Conclusions.* The general conclusion reached was that a safe, palatable water with improved quality could be produced by the treatment plant even during conditions of low flow in Clear Creek, though certain improvements both with regard to operation and new construction would be desirable.

Future Supplies

Although the results of the test runs proved that treated water of good quality could be produced from the present surface source, it was felt that the problem of public acceptance for aesthetic reasons might still exist. Also, the treatment process was relatively expensive and there was possibility of error due to the changing conditions of raw water. Consequently, it was decided to determine the underground water source potential, not as the ultimate answer, but with the idea of satisfying the immediate need. The wells could supply the winter demand when the surface water was most difficult to treat. The water treatment plant could then be operated to supplement the well water in the summer and during other peak periods.

The results of the underground investigation indicated that only an additional 500 to 600 gpm could be obtained from deep wells drilled to the same strata as the existing two wells previously mentioned.

It was also found that an additional 900 gpm was possible from two or three shallow wells; however, this was subject to considerable testing before water from this source could be assured. This shallow water would require softening as well as chlorination.

The long range considerations involved the investigation of an addi-

tional surface supply from a good source. Discussions with the Denver Water Board revealed that they were interested but non-committal as to when they could furnish additional water. The other alternatives were to bring in water from the various streams and rivers on the eastern slope of the Continental Divide.

All long range schemes proved economically unfeasible for the Baker District alone. It would be necessary for the District to combine with other Districts and municipalities in order to utilize these resources.

Recommendations

Recommendations to the Board of Directors for Phase "A" were divided into three categories: Immediate, very near future, and long range. The recommendations of interest included the following:

For immediate consideration: Drill three additional deep wells as soon as possible. Suggested locations were pinpointed and two of these are now in operation. This brings the total ground water available at this time to approximately 700 gpm or slightly over 1 mgd. All wells pump constantly and peaking is cared for by the treatment plant.

Operational improvements suggested at the treatment plant included:

1) Operate the plant to meet peak demands which cannot be supplied from the wells.

2) Start the plant at least 3 hours prior to turning water into the system and bypass the plant effluent through the newly constructed bypass pipe line into the raw water storage pond. This procedure is to be continued only until tests indicate that treatment results in a potable water with sufficient chlorine residual before turning it into the distribution system.

Construction improvements suggested at the treatment plant included:

1) Construct a new inlet structure to the raw water storage pond and redesign and reconstruct the outlet structure to lessen the possibility of short circuiting.

2) Install an activated carbon feeding device of sufficient size to allow large dosages to be applied to the raw water so as to provide more effective removal of tastes, odors and detergents.

3) Install two chlorine flow meters to make it possible to control more accurately the amount of chlorine being applied to the raw water and to the clear well.

4) Purchase the chlorine dioxide generator which had been loaned on a trial basis; the use of chlorine dioxide had proved very effective in the test runs.

5) Purchase a small oven and equipment for bacterial sampling.

6) Install a collection trough in the aeration portion of the clarification basin with a drain to waste for the purpose of collecting as much detergent foam as possible. This procedure did reduce the high billowy clouds of foam that formed especially during periods of low flow. The newly appointed Superintendent, W. H. Findley, decided to try a sprinkler system in conjunction with the trough. This proved to be very effective in practically eliminating the foam. There is reason to believe that at least a small amount of detergent is removed by this method.

7) The Baker Plant lacks rate of flow controllers and is so constructed that in the event the small clear well is pumped to a low level, the available head is excessive and can create velocities through the sand which could materially decrease the quality of the water. It was suggested that rate controllers be installed.

Near future recommendations included the following:

1) Investigate the possibility of acquiring water from Ralston Creek through the Manhart Ditch. This source was thought to be not too reliable in drought years and was tentatively disregarded pending further investigation.

2) Acquire or construct earthen ponds adequate to provide 15 to 30 days retention (or more) for the purpose of raw water storage, oxidation, breakdown of detergents and subsequent taste and odor control as well as possible bacterial reduction. There are some existing ponds formed by gravel removal along the Clear Creek bottom which could be used with very little construction cost involved. Subsequent negotiations between the District and the owners of the Cooley Lakes are promising.

3) Consider transporting the raw water in a closed conduit from the Cooley Lakes if they are required.

4) Make small test borings into the surface gravels to determine the feasibility of developing a shallow water source. This suggestion is still being contemplated.

The long range recommendations included the suggestion that a program be initiated to obtain additional surface water by combining with other quasi-municipal corporations. Water from South Boulder Creek was specifically mentioned as a good source.

Upon the submission of Phase "A", the Board of Directors immediately started to take action on the recommendations while Phase "B" was being initiated by the District personnel and the consulting engineers. Of the recommendations for immediate consideration enumerated above practically all were put into effect during the first year of operation.

The results of the test runs were used as a basis for operating the plant and variations were developed as time progressed. For example, breakpoint chlorination was applied to the aeration basin mainly for reasons of safety. It was contemplated that chlorine dioxide could be applied in the clear well to combat taste and odors; however, this has not been necessary to date. Algae control in the pond has been attained by the addition of copper sulfate and activated carbon around the edges.

The overall results have been excellent. Tastes and odors have become practically nonexistent. A slight amount of foaming on filling a glass is still noticeable at times but is not objectionable. Consumer complaints gradually subsided to practically none by the end of 1959.

The State Health Dept. as well as the Tri-County Health Dept. have found no unsafe samples. The results of bacterial testing at the treatment plant have revealed nothing but safe samples.

This change for the better has not dimmed the search for a new water source, but near future and long range planning has been affected by a recent turn of events. The Denver Water Board's so-called "Blue Line" beyond which Denver would heretofore not sell water has been abolished. This development will enable negotiation with Denver for the purchase of either raw or treated water; however, since the treatment plant is in existence, raw water is being more seriously considered. The quality of this particular source is excellent with no sewage pollution to contend with.

Acquisition of this water will present financial difficulties which will be difficult to overcome but with the recent promotion of W. H. Findley from Superintendent to District Manager and the continued devotion of the Board of Directors to the problem, there is little doubt that a satisfactory solution cannot be accomplished.

WINTER Maintenance Requires Year-Around Planning

RALPH R. BARTELSMEYER
Chief Highway Engineer,
Division of Highways
Springfield, Illinois

PLANNING and preparing for snow removal and ice control is a continuous process in Illinois. In December the maintenance engineers in our ten highway districts are beginning to plan for snow and ice removal a year from that time. They are listing the equipment which will have to be replaced before that time and adding to that list the additional equipment which will be required to maintain the new pavements to be constructed during the summer months. These lists are sent to our Bureau of Maintenance office in Springfield where specifications are prepared by our equipment engineer. During the late spring and early summer, proposals are mailed to prospective bidders. Bids are then taken on snow plows, abrasive spreaders and trucks with the delivery date usually specified as October 1.

Bids are also taken during June or July on calcium chloride and sodium chloride so that awards can be made and our stockpiles and bins filled before the first snow is expected.

Abrasives in the form of cinders and sand are stockpiled beginning in September. Cinders are still preferred as an abrasive though our sources of supply have diminished in the past few years due to the dieselization of the railroads and the conversion of some manufacturing plants to other than a coal-burning operation. Since they are sharp and porous, cinders are capable of retaining more of the chloride brine and embed themselves better in packed snow or ice. Because they are black, they are visible and leave no doubt in the mind of the traveling public that something has been spread over the packed snow or ice to make it less slippery.

Many miles of snow fence are erected in September and October at places where excessive drifting has been experienced. The underbody push frames are also mounted on our trucks in October and our plows and cinder spreaders are given a trial run so that personnel can again become familiar with the operation.

Meetings are held also in October and November during which snow and ice control procedures are reviewed. New ideas are voiced and discussed. Our field men, at this time, make contacts with the contractors in their local areas and prepare lists of contractors' equipment which would be suitable for removing snow, should the occasion arise when additional and heavier equipment is required. Rental rates for this equipment are established at this time so that when an emergency arises a contractor can be called who can immediately put his equipment to work.

The primary system of highways in Illinois consists of approximately 14,400 miles of paved roads. The State is divided into ten districts. Each district has a complete main-

● **THIS IS a winter day along a highway in Winnebago County, near Rockford, Ill. A big rotary snow plow is opening up drifts that appear to be several feet in depth.**

● **HELICOPTER** *permits checking on the progress of the work even at times when many highways are impassable due to deep snow and drifts. Along with two-way radio, the helicopter facilitates direct supervision of work during emergencies.*

tenance organization and is equipped to take care of any normally expected storm. Since Illinois enjoys a great length, it is seldom that an intense storm will engulf the whole State at one time. During times of heavy snowfall and drifting, if a district finds it cannot cope with the storm by using its own equipment, it may request help from other districts which are not affected by the storm. Only during such emergencies will the Bureau of Maintenance exercise jurisdiction in the dispatching of equipment between districts.

During a storm regular reports are made to the Bureau office where road condition reports are assembled and given to the various news agencies so that the public may have first hand information on road conditions.

Equipment Used

For maintenance purposes, the districts are divided into maintenance sections which are approximately twenty miles in length. In the northern half of the State, normally a 2½-ton truck is assigned to a maintenance section. Most of these trucks are equipped with both blade and V-plows as well as mechanical end-gate abrasive spreaders. During severe storms, the section trucks are augmented by 4-ton trucks and 4 and 6-ton four-wheel-drive trucks. Our four-wheel-drive trucks have wing plows mounted on the right side. In the southern portion of the State, 1½-ton trucks are standard on the maintenance sections. These trucks usually are provided only with a blade plow, but they also have mechanical end-gate spreaders. The gravity-fed end-gate spreader has been almost universal in the past, but we are rapidly changing to the hydraulically-driven spinner type of end-gate spreader. Our Division-owned motor patrol graders are also called upon at times to plow snow. Some of our larger graders are equipped with V and wing plows. We have four rotary snow blowers stationed in the northern part of the State. In an effort to speed the spreading of abrasives on ice-covered or snow-packed highways, we have acquired some larger units in the past few years. These are tandem axle trucks with 13-cu. yd. hopper body type spreaders. With the advent of additional miles of express highways, these units are becoming very popular and more are being requested.

The use of calcium chloride for treating abrasives has been practiced for a number of years, but only in the last seven or eight years has direct application of rock salt to the pavement become standard practice In treating abrasives (usually cinders or sand) calcium chloride is mixed with the abrasive, at the time it is stockpiled, in sufficient quantities to keep the material from freezing into a solid mass. Additional salts, either calcium chloride or sodium chloride, are added when the abrasives are loaded into the trucks prior to spreading, in order to get each abrasive particle covered with a film of brine so that it will embed itself in the ice or packed snow. Sodium chloride or rock salt is widely used for direct application to hasten thawing. We have specified that a maximum of not over five hundred pounds of salt per mile of two-lane pavement is to be used. For the most part, rock salt is dropped along the centerline of the pavement. As it dissolves, it forms a brine that works toward the edges. A bare wheel track soon appears near the center where the brine is strong. This gives a measure of safety to traffic. On two-lane pavements, this method works well but on four-lane pavements some type of equipment that spreads a pattern of salt is preferred. Our hopper-body spinner type spreaders come into play here as well as the new end-gate spinner spreaders. The past two winters we have been experimenting with mixtures of calcium chloride and sodium chloride, as have been our neighboring states. Varied results have been obtained but we believe the mixture will melt the packed snow or ice from the pavement at lower temperatures than would rock salt alone.

Occasionally, the use of rock salt has brought unfavorable results. A sudden drop in temperature about the time the brine is being formed can freeze the brine on the pavement and create a more slippery condition than had originally existed. With a dry snow and light winds, finger drifts might form across the pavement. If the pavement is dry, these may not be serious but if the pavement is wet with salt brine these fingers can freeze into fingers of ice. Therefore, the probability of a rise or fall in temperature should be considered when using salt or a mixture of the chlorides.

Abrasives are usually stockpiled in quantities from one-hundred to two-thousand cu. yd. An effort is made to locate the large stockpile

sufficiently close so that empty trucks need not drive more than ten miles to replenish their supplies. Cinders are loaded with small end loaders mounted on mower tractors. These small tractors are owned in sufficient numbers so that one is available for every stockpile in the State. Normal practice limits the spreading of abrasives to critical areas such as in advance of stop signs, on steep hills and curves, and on either side of railroad crossings. However, in the case of extremely hazardous conditions, as for example when the pavements are covered with a slick and very slippery ice that is apparently unaffected by salt because the temperature is too low, additional abrasives are applied as rapidly as possible.

The northern districts have frequent occasions to plow deep snow. For this reason, they are generally furnished with heavier equipment. As indicated before, in addition to the section trucks in the northern part of the State, we have 221 trucks of from 4- to 6-ton capacity. We have 622 V-type plows for trucks, 11 V-type plows for motor graders, and 115 wing plows for trucks and graders.

Many of our V-type plows may remain unused for one or more entire winters. Nevertheless, they are considered essential because our blade plows are not designed to move deep snow and contractors' equipment is not available in sufficient numbers to remove the snow as fast as is required today.

Snow fence is used in eight of our ten districts. The cost of erecting, dismantling and storing the fence is an appreciable item in snow removal costs and is incurred annually. After a winter of light snowfall, interest in snow fence lags. However, the reverse is true after a winter of heavy snows.

All districts issue snow removal instructions in early October. Instruction are given by letter, through group meetings, or a combination of the two. They are modified each year to conform to new policies or practices as in the direct application of salt or the mixing of the two chlorides for direct application but in the main they are similar from year to year. Their value lies in constantly reminding snow-plow operators and supervisory personnel how preparations should be made and of precautions that should be taken before the snow season arrives.

During ice storms, maintenance forces are required to work until all critical areas are covered with abrasives or, if temperatures permit, until salt is spread on the pavement and the ice melts. In snow storms, maintenance forces must work until two-way traffic is restored. Widening will be done during regular daylight working hours if it is required. If the snowfall is moderately heavy, and if it is followed by high winds, it may be necessary to work around the clock for one or several days to restore two-way traffic.

The heavy snow, followed with drifting that requires several days of continuous work, presents the problem of how to keep the equipment manned for continuous operation. The section man and his helper are both drivers; consequently, each can take a 12-hour shift provided that a temporary helper can be hired for each shift. Experience has shown so many reasons for the presence of a second man on each snow-plow truck that it is now more or less mandatory for a helper to be with each plow.

Storm Warning Service

Our planning for specific storms has been assisted in the past several years by a commercial storm-warning service. This service acts as an alarm clock to alert us and tell us the probable intensity and duration of a storm. If the storm is to be of long duration, we arrange for shifts and call on relief drivers. Otherwise, we carry on with our regular forces. All snow-plow operators are instructed to call their assigned headquarters when they start to plow snow or to spread salt or abrasives. They are instructed to call again when they have completed their work. If the storm is of long duration, they must call at intervals of three to four hours. The information thus furnished enables supervisory personnel to shift equipment as needed and to prepare road condition reports which are to be submitted to the district office so that inquiries from motorists can be answered. As indicated previously, each district gives the central office a road condition report twice a day. These reports are summarized and a brief general report is sent by telegram to various news services, radio stations, and motor clubs. Several hours may have elapsed since the first snow-plow operator reported his road conditions, so our reports are not always as accurate as we would wish. If conditions are in a state of change, as frequently happens, a report one or several hours old will not truly reflect conditions.

We are convinced that two-way radio will bring us much advantage in snow removal operations and, therefore, hope that such a system may be made available to us in the near future.

Keeping the highways in the State of Illinois passable during the winter months is an expensive, though necessary, operation. Currently, about five million dollars is expended annually for snow removal and ice control purposes.

GIANT PIPE REPLACES BRIDGE

FREDERICK R. LEMCKE
County Engineer
Greene County, Ohio

ON THE Wilberforce-Clifton Road in Greene, County, Ohio, a new bridge was needed at the Massie's Creek crossing to replace the old steel through truss structure. Abutments were crumbling and twisted, the deck was narrow, alignment was poor and load limits were far too low. Costs for replacement and realignment with another steel span bridge was prohibitive. A less costly method had to be found.

An 18-foot diameter, 7 and 10-gage, Armco Multi-Plate structure—much larger and lighter than shown in present gage tables—was designed to carry the road diagonally across the stream bed. Success of the structure depended in a large part on proper compaction of backfill at all stages of construction. The job was to be done by county crews and equipment.

Final design called for a 204-ft.-long, 18-ft. diameter sectional Multi-Plate structure, five percent ellipsed. The bottom three rows of plates, plus the 2:1 step-beveled end plates, were fabricated from 7-gage galvanized steel. All other plates

● **REPLACING old bridge, shown at top. County crews constructed 18-foot diameter, 7 and 10-gage multi-plate culvert.**

● **UNDERCUTTING at outlet end, with possible damage to embankment, was prevented by constructing a concrete headwall.**

were formed from 10-gage galvanized steel.

Before construction could begin, creek bottom muck was removed and a stable base of crushed stone was laid. This improved foundation stability was necessary to hold both the structure and the heavily compacted fill to come.

As soon as line and grade were established, erection proceeded rapidly. One end of the structure was completed while the three rows of bottom plates were laid the full 204 feet. A simple scaffold then was built inside the end ring so the men could work inside at the top. It was moved forward as each three-sectioned ring was completed.

Because backfilling would be supervised closely, it was determined that neither vertical nor horizontal strutting was necessary. To make sure of effectiveness of the fill, engineers took careful measurements of the completed structure as it stood on its gravel foundation. Measurements were retaken at various stages of backfilling to make certain that compaction of the backfill was adequate and proper.

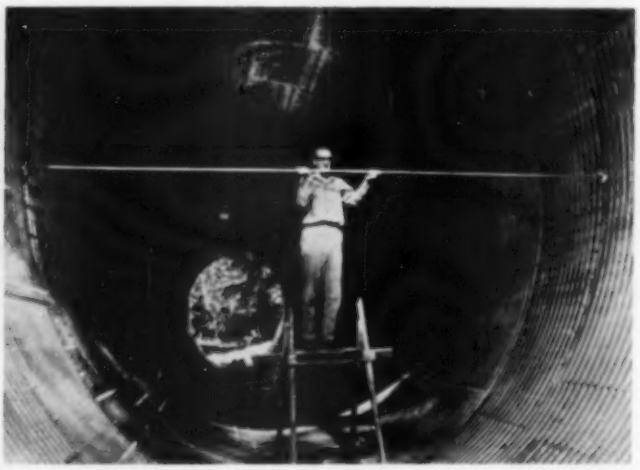
Compaction of backfill was done with 3 different types of equipment, the material being placed and compacted in layers not over six inches thick. A pneumatic tamper was used under the haunches of the pipe and far enough out for the next type of equipment to take over. This was a gasoline driven, hand operated vibrating tamper which compacted the backfill for a distance of about 2 feet out from the edge of the pipe. Sheepsfoot rollers took over from this point. The entire backfilling operation was carried on with the idea of using the most economical compaction equipment as close to the pipe as possible. The limit of each piece of equipment was controlled by the requirement that the horizontal diameter should not be reduced more than 2 per cent. Compaction proved by tests to be above the acceptable Proctor density and no appreciable change in shape occurred.

With a bare 6-in. earth cover, a D-6 bulldozer was driven onto and "parked" on the structure, which deflected about 1/8 in. along the vertical axis. The structure regained about 1/16 in. when the dozer was driven off. A sheepsfoot rolier was pulled on and off but caused no deflection.

Before final live-load testing, an additional 4-in. cover of earth was compacted over the pipe. A 46,000-lb. dump truck, with 36,000 lbs. over the rear axle, was halted on the structure. The pipe deflected 1/8 in., but regained more than 1/16 in. when the truck was driven off. In total, less than 1/8 in. change was recorded. This was assumed to be take-up in the bolt holes, since no change took place along the horizontal axis. The final 10-ft. cover was added after these load tests.

Three important points were demonstrated by this Multi-Plate structure. First, by engineering the backfill for best possible compaction, an increase in structure size plus a reduction in gage can be accomplished successfully. Second, good compaction can be attained by inexperienced workers with good supervision. Third, adequate compaction can be achieved without using struts to hold the pipe in shape while backfilling is done.

● **OMPACTING the backfill, using air and vibrating tampers. Sheepsfoot roller was used at upper level.**



● **HORIZONTAL and vertical measurements were made regularly as backfilling progressed to assure proper cross-section was obtained.**

STEPS IN SOLVING OUR PROBLEMS OF POLLUTION CONTROL

Most of our readers are familiar with the Federal program of construction grants for sewage treatment plants. Many of them have participated, or have been interested observers, in the planning or construction involved in the 2156 projects approved to the end of last June. It seems desirable, after four years of experience in this program, to summarize what has been accomplished; but it is even more important to emphasize that the construction grant program is only a portion of a much broader effort to reclaim our water resources. For planning and for programing work it is necessary to have basic data; to accomplish results, cooperative work with many state and federal agencies is required; research is requisite to find better ways of doing old jobs and to solve new problems; and legal and financial aspects must be reviewed in the light of modern conditions in order to facilitate the pollution abatement program.

To provide much of this necessary background and to present a fair and factual picture of the needs and the progress we went to Washington and talked with Public Health Service officials and engineers. Their help has been very considerable and has included much of the factual data presented in this article, as well as the accompanying map which illustrates data on several of the activities described in the text of the article which follows.

NEVER before has a Nation recorded the tremendous use of water we are witnessing in this era of home building, industrial expansion and technological progress. Some 180 million people in the United States are using more than 300 billion gallons of water daily. By 1980, only 20 years away, we will be withdrawing as much water from both surface and underground sources as we can develop. The only logical way to meet water requirements in the decades ahead seems to be to use our surface waters over and over again as they flow to the sea. In many areas this is common practice, but it must be expanded and enlarged; and water reuse, of course, requires pollution abatement to assure a usable quality.

Waste Treatment Needs

In many instances towns and cities are fighting a losing battle in trying to meet the water pollution problems of the Atomic Age with Model T equipment. The need for sewage and waste treatment plants is mounting despite an upsurge in construction which came with the post-war years. Not since the made-work programs of the thirties has sewage treatment plant construction kept pace with needs. The latest Public Health Service inventory reveals a $2 billion national backlog of needed municipal projects; some 2900 new plants are needed in communities discharging raw sewage to streams; 900 obsolete plants should be replaced; and 1600 plants need enlarging or improving. One of every three in operation is inadequate.

In all, sewage treatment plants are needed to serve 48 million people—nearly half of all who live in sewered areas of the Nation. Nor does this tell the whole story. Hundreds of unsewered septic tank suburbias are adding to pollution problems because of inadequate or improperly installed home disposal units.

Each year additional sewage treatment facilities join the worn-out or overloaded groups. Populations keep growing; industry continues to expand. To wipe out the backlog and to meet the new needs will require the cities of this country to spend $600 million a year for the foreseeable future. And, while comparable figures for industry's waste treatment construction needs are lacking, they are believed to parallel or to exceed municipal needs. Plants that must be built for industries now discharging untreated wastes to streams represent tremendous figures in construction dollars.

The Department of Commerce estimates that $170 billion will be invested in water resources developments between now and 1975. Water and sewerage utilities account for nearly one-third of this total.

Federal Pollution Control Laws

When the present Federal Water Pollution Control Act (Public Law 660, 84th Congress) was passed by Congress and approved by the President, July 9, 1956, it was heralded as the most forward looking and comprehensive authority ever handed to the Federal government to get the job done. But needs are

not static; and to meet changing conditions, the Department of Health, Education, and Welfare has asked Congress to consider amendments as follows:

1) Strengthen State and interstate water pollution control programs by extending Federal program grants another five years; 2) make more effective assistance to municipalities in the construction of necessary sewage treatment works by permitting two or more communities to pool their Federal construction grants and to permit reallocation of construction grant funds when not used; 3) provide for more effective prevention and control of pollution caused by Federal installations; 4) strengthen the enforcement role of the Federal government in abating pollution of interstate waters.

Some of the Federal laws concerned with water pollution date back many years. The Rivers and Harbors Act of 1899 and the Oil Pollution Act of 1924, primarily concerned with preventing damage to shipping, are administered by the Department of Defense. The 1899 Act prohibits the depositing of waste materials, other than that flowing from streets and sewers in a liquid state, in or on the banks of navigable waters and their tributaries. The 1924 Act prohibits the discharge of oil into the coastal navigable waters of the United States.

The third major Federal enactment regarding water pollution was a provision in the Public Health Service Act of 1912, which gave specific authority to that Service to conduct investigations of the pollution of streams and lakes by sewage and other causes. Under this legislation the Public Health Service carried out early research and investigations that provided invaluable information and established the basis for information and consultative services.

The first comprehensive type legislation in the pollution control field was the Water Pollution Control Act of 1948 (Public Law 845, 80th Congress), which authorized expanded activities by the Public Health Service. This law, passed after many years of consideration of national water pollution problems and evaluation of the responsibility of the Federal Government, added the principles of State-Federal cooperative program development, limited Federal enforcement authority and financial aid.

Still further concern of the Federal government in the growing national pollution problem was demonstrated in the Water Pollution Control Act of 1956. Many of its principles and provisions are carryovers from the Act of 1948, and the Federal role was further extended.

How does the law function? How well are its objectives being met? Where do the shortcomings of the water pollution control effort lie? Experience gained in the four years 1956-1960 under Public Law 660 provides some answers and indicates what must be accomplished during the 1960's and 1970's.

Administration

The Federal Water Pollution Control Act is administered by the Surgeon General of the Public Health Service under direction of the Secretary HEW. Its provisions are carried out by the Division of Water Supply and Pollution Control, which, prior to April, 1959, was a part of the Division of Sanitary Engineering Services. Its elevation to divisional status within the Public Health Service was indicative of the greater importance water pollution control is assuming with each passing year.

The Division maintains a small staff in Washington to determine policy, guide program direction and coordinate with other Federal agencies. The majority of staff works in and from the nine Regional Offices of HEW and the Robert A. Taft Sanitary Engineering Center at Cincinnati. These field staffs carry on most Division program activities since they are close to the problems and have established good working relationships with the State, interstate and local agencies involved.

In the Federal Water Pollution Control Act, Congress emphasized that primary responsibility for water pollution control rests with the States, placing the Federal government in a supporting role. Thus the Public Health Service encourages the basic principle of local-State-Federal teamwork.

A proposed reorganization of the Public Health Service looks toward fulfilling national needs as they will develop over the next decade. It would place water pollution control in a new Bureau of Environmental Health along with other programs of air pollution, radiological health, milk and food sanitation, general

Courtesy U. S. Public Health Service

● **BASIC DATA on stream conditions are necessary. Samples collected by the national water quality network are examined for coliforms, radioactivity, synthetics, etc.**

engineering and occupational health activities. The authority of each, as presently defined, would remain basically unchanged. The proposal recognizes the need for a plan to cope better with the health problems of the environment in which we now live.

Water Pollution Control Advisory Board

A nine-member Water Pollution Control Advisory Board, appointed by the President, is authorized by Public Law 660. The terms are staggered, with three new members selected annually for three-year terms. They are chosen from men in industry, conservation, civic affairs and State and local government who have demonstrated an active interest in water pollution control. Members are not eligible for immediate appointment to succeed themselves. The chairman of the Board is the Surgeon General. The Board advises, consults with and makes recommendations to him on policy relating to his responsibilities under the Federal Water Pollution Control Act. The Board will meet four times a year.

Primary needs in water pollution control at the Federal level are reflected in the Advisory Board's recent actions. It has recommended among other things: 1) Accelerated and expanded research in water pollution control; 2) strengthened enforcement authority in the Federal Water Pollution Control Act; 3) closer cooperation of all Federal and other public installations in controlling pollution from their waste disposal systems; 4) establishment of additional cooperative local-State-Public Health Service water quality sampling stations; and 5) clear identification of water pollution control items in the annual budget.

Data on Which to Base Activities

Every successful business keeps books on its assets and liabilities. In the Division of Water Supply and Pollution Control a Basic Data Branch collects and records information on the sources, kinds and amounts of pollution in our major streams and the causes and effects of pollution. Data are collected on the present and future uses of waters; the kinds, costs and effectiveness of treatment facilities; the costs and benefits associated with pollution control; and allied engineering, scientific and economic information. Successful management of water resources must have such data on which to base procedures.

The basic data function is one authority of Public Law 660 which, from the beginning, has been delayed by lack of sufficient funds. In many instances even the sources of some of the wastes entering our streams and lakes are not known; this is especially true of industrial wastes. Information on the strength, volume or characteristics of many of the wastes, and exactly what happens to them after they reach a stream is also lacking. Major problems are posed by the inadequacy of data on industrial wastes and agricultural chemicals.

Basic data need to be collected, evaluated and distributed on a cooperative basis among the water resource agencies concerned. To be more usable the data need to be collected in all river basins; to be more reliable the data need be made available on a continuing basis. We need to know where and why we are gaining or losing ground in controlling pollution. We need to maintain a running record of what is occurring in our waters so we can detect pollution situations as they arise and before they become major problems.

A national water quality network, set up in 1957, has grown to 75 sampling stations along interstate streams. These are operated by the Public Health Service in cooperation with local agencies and are supplemented by several hundred intrastate stream stations operated by State and local agencies. An eventual national surveillance network of 300 stations is planned with an increase to 120 for 1961.

Principal objective of the stream sampling network is measurement of long-term trends in water quality. Collected samples are examined for coliform bacteria, aquatic organisms, radioactivity, synthetic organic chemicals and various other substances.

A reporting system, inaugurated last June and operated in cooperation with State conservation agencies, will determine the extent of pollution-caused fish kills and will further aid the program of water quality monitoring.

Inventories are also kept in the Basic Data Branch covering physical, operating and related information on water supply, sewage and industrial wastes distribution, collection and treatment facilities. Such information is generally obtained through and in cooperation with the State health and water pollution control agencies. While data for municipal and other public facilities are essentially complete, data on industrial wastes still need to be greatly expanded. Contract awards and municipal bond sales for water and sewerage facilities are compiled monthly and issued in annual reports.

Studies to develop economic evaluations of pollution and its control are also part of the program of basic data. The Nation and its communities, business and individuals, incur losses or damages because of water pollution other than the direct costs of treatment facil-

Courtesy Process Engineers Div., Kimco Corp.

● **SEWAGE treatment plant serving Salt Lake County, Utah, Sanitary District No. 2, utilizes modern equipment. Grit collector and washer are shown in the foreground.**

ities. Such damages from pollution as health impairment, loss of fishing and recreational uses and depreciated property values have an adverse economic impact. However, it is difficult to place specific values on either pollution damages or pollution control benefits. The application of basic economics is needed to develop valid yardsticks by which reliable dollar measurements can be made.

This type of data will provide the answers to such important questions as: What does water pollution cost a community, a region or the Nation in damages? What are the specific benefits from alleviation of these damages and what is their economic worth? Who will benefit from the control of pollution and to what extent? How much can be justifiably spent in controlling a pollution situation? How should the costs be apportioned among members of the community, the region and the Nation?

Much remains to be done to extend the coverage of basic data collecting programs. This should include not only surface water resources but ground water supplies as well. A dozen or more States have basic water quality data collection programs under way. More work will be needed before adequate water quality intelligence is available.

Research

The latest (1958) inventory of research projects directed to water supply and pollution control lists 280 projects. These projects are being conducted by the following agencies: Universities 205; State and interstate agencies 25; Federal 23; industrial organizations 17; and local agencies 10. Support for this research comes from the following sources: Universities $143,000; State agencies $928,000; Federal agencies $1,878,000; industrial organizations $464,000; and local agencies $87,000. It will be noted that most of the work is being done at Universities, but most of the support is coming from other sources.

The Public Health Service believes that field laboratories situated geographically to complement the R. A. Taft Sanitary Engineering Center are needed to assist further in State and regional water problems.

There is a pressing need to develop totally new treatment processes which will remove much more of the contaminants from municipal wastes. Present so-called "complete" treatment is but 75 to 90 percent efficient, and this applies only to certain components of wastes. The nitrogen and phosphorous remaining in sewage effluents encourage algae growths below many sewer outfalls. Algal decay is responsible for increasing taste and odor problems in water supplies. Stream flow must still be depended upon to dilute and transport the residual wastes after treatment. As cities grow and distances between water intakes and sewer outfalls shrink, research must find ways to provide more efficient removals of wastes by treatment.

Courtesy Dorr-Oliver Inc

● **TWO-STAGE biofiltration plant serves the Manzanita Sewer Assessment District, Sacramento, Calif., providing a high degree of treatment to reduce stream pollution.**

Also, the chemical products age has brought new problems—most of them unknown prior to World War II. For example, synthetic organic chemicals often are undetected and unsuspected stream pollutants. Alkyl benzene sulfonate, the basic ingredient of household detergents, might still be unsuspected if it were not for the foam it causes at sewage treatment plants and in streams. This same substance is invading ground water supplies in many unsewered areas where homes are served by individual disposal systems and private water wells. Notable trouble spots are Long Island, New York, and suburban sectors of the Minneapolis-St. Paul area.

Research scientists suspect the presence of other substances, equally resistant to treatment and as persistent in our streams, which give no clue to their identity. One, identified as orthochloronitrobenzene, was traced in the Mississippi River a thousand miles from its point of entry into the stream.

Radioactive wastes in waters are giving increasing concern, as is thermal (heat) pollution from power plants and industrial cooling systems. The exhaust from outboard motors in waters heavily used by boats is under surveillance as another pollutant. Agricultural insecticides in water supplies pose some unsolved problems. DDT has frequently been recovered from streams and even from treated water supplies. Of particular concern is one of the new chlorinated hydrocarbon insecticides, the most toxic material yet encountered for fish. We must learn how to control a waste whose source is general land drainage rather than a specifically located outfall sewer.

Technical Assistance

Many States have municipal and industrial waste problems of unusual nature on which they request and receive assistance from the Public Health Service. These include full-scale river basin studies, evaluation of laboratory operations and other specialized investigations.

Brine pollution in the Southwest caused by natural salt deposits and oil field operations is one regional problem. It seriously affects the major water resource of an already watershort area. The Public Health Service, in cooperation with the Army Corps of Engineers, and the States of Kansas, Oklahoma and Texas, is carrying out a water quality conservation project in the Arkansas-Red River basin. The goal of this intensive study, now in its

fourth year, is to develop a plan to eliminate or control brine pollution.

Another project which also impinges on basic data involves an inventory of waste disposal at Federal establishments. This will assist Federal agencies in determining what corrective actions may be required to eliminate conditions at installations which are contributing to the pollution of waters. The Federal Water Pollution Control Act declares it to be the intent of Congress that Federal installations cooperate to control pollution. It is hoped this inventory (to be completed early in 1961) will result in remedial action.

Still another important technical service is that of giving advanced training for engineers, chemists and other scientists from Federal and State agencies, municipalities and industries. Short, intensive laboratory and classroom courses are given at the Sanitary Engineering Center at Cincinnati. Seminars and conferences on major subjects of interest in the water supply and pollution control field are held there also.

Comprehensive Pollution Control Programs

Effective water quality management requires comprehensive pollution control programing. For nearly 30 years the tendency has been toward basinwide and regional water resource planning. First efforts were those of the National Resources Planning Board in the 1930's. Programs of the Tennessee Valley Authority, the Coulee Basin, the Missouri Basin, the New England-New York Inter-Agency Committee, and others have followed.

Truly comprehensive river basin planning is a long, involved and costly, yet necessary, process. All factors, present and future, must be correlated to determine optimum possible use of the river. Plans must remain flexible and subject to change as conditions in the basin change. State water pollution control agencies, State and Federal construction agencies, research institutes, banking, industrial, legislative and other interests should participate for broadest benefits.

It is estimated that the preparation of a plan for a comprehensive pollution control program for a moderate-size river basin would take three to four years and might cost somewhere between $1 million and $3 million. A nationwide program of such studies, looking toward the ultimate long-range water quality management of all rivers for optimum use, might well require continuing expenditures of perhaps $8 million or more per year for many years. Nevertheless, in view of the increasing demands upon our definitely limited water resources, such a program seems essential.

The largest comprehensive water pollution cleanup yet attempted was launched this year by the Public Health Service in cooperation with the seven States of the Colorado River Basin.. The mainstream and its 60 tributaries drain one-twelfth of the total land area of the United States. In addition to State water pollution control agencies of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, the Federal Departments of Agriculture, Commerce, Defense, Interior, Labor, and the Federal Power Commission were invited to cooperate. And, since the Colorado is an international stream, the International Boundary Commission concerned with Mexican-United States relationships is also expected to participate.

Courtesy N. Y. State Conservation Dep't.

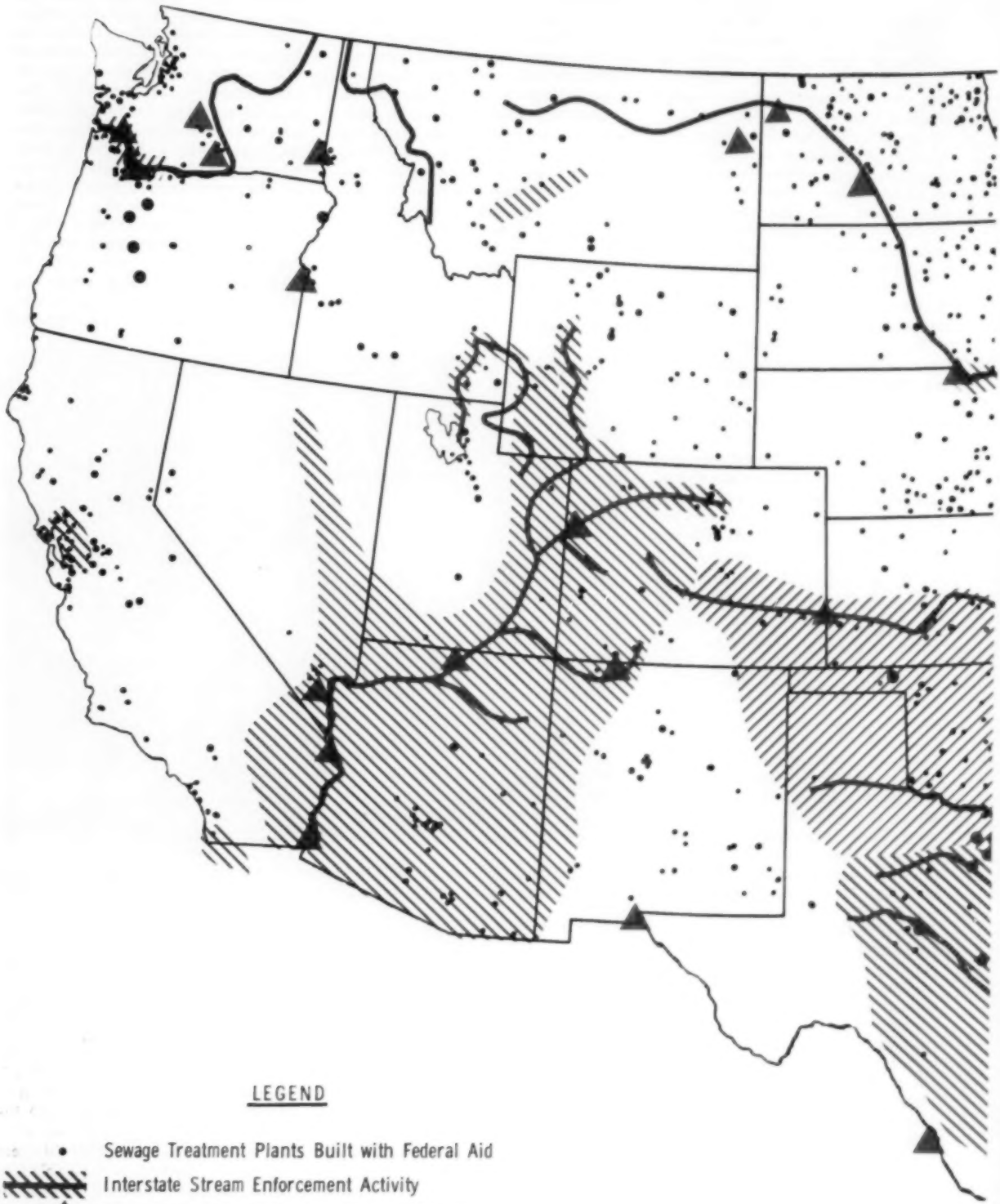
● **BOATING can add seriously to the pollution problem. This view of Huntington Harbor, Long Island, N. Y., illustrates a problem that requires study and research.**

Enforcement

Not until the 1956 enactment of Public Law 660 was there any effective provision for the Federal government to take legal action to abate pollution. Accelerated enforcement was initiated and has gained impetus during the ensuing four years. Under this law where pollution of interstate waters endangers the health or welfare of persons in a State other than the one in which the pollution originates, the Surgeon General and the Secretary HEW are empowered to take action to enforce its control. The procedure calls for: 1) A conference called by the Surgeon General with the State and interstate agencies involved; 2) a public hearing before a board appointed by the Secretary; and 3) Federal court action instituted by the Attorney General. Each step is taken only if the previous one has not been effective.

Enforcement actions have been taken in 12 interstate pollution situations. Involved is the abatement of pollution in 4,000 miles of interstate streams. The Public Health Service estimates that the remedial measures agreed upon at the conferences and required by findings of the public hearings will include the construction of at least $500 million of waste treatment facilities. In addition, the Public Health Service is developing and maintaining continuing dockets on about 2,000 interstate pollution problem areas.

Congress has been asked this year to make all interstate navigable waters and coastal waters subject to the Federal pollution abatement enforcement authority whether or not there is a showing of interstate pollution. Such action would be subject to a request from a State or from a municipality with concurrence of the State. It was also pro-

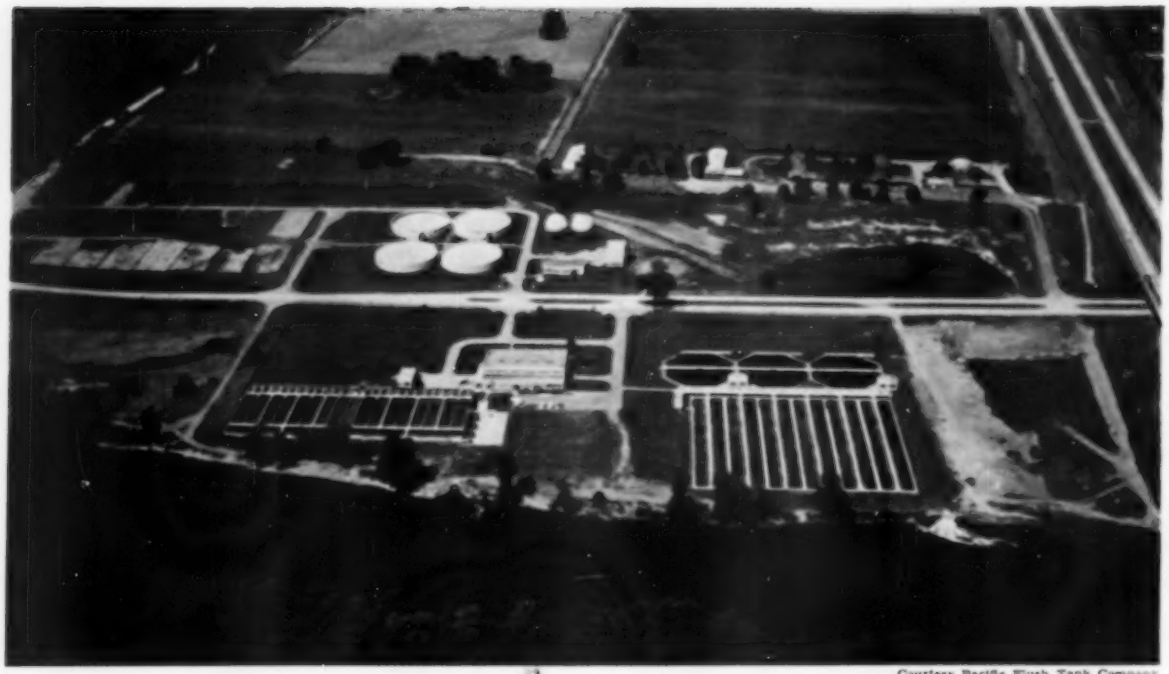


LEGEND

- Sewage Treatment Plants Built with Federal Aid
- Interstate Stream Enforcement Activity
- Stream Sampling Stations - National Network
- Technical Assistance and Special Basin Projects
- PHS Projects under the Water Supply Act of 1958
- Sanitary Engineering Center - Cincinnati

WATER POLLUTION CONTROL ACTIVITIES

U.S. Public Health Service and Cooperating Agencies



Courtesy Pacific Flush Tank Company

● **MODERN activated sludge plant at South Bend, Indiana, has restored long lost recreational facilities to the St. Joseph River.**

posed that the Secretary HEW be authorized to issue final orders after the public hearing stage of the enforcement procedure.

Such enforcement procedures work slowly at best. Moving in the first step requires weeks of stream studies, collection and analysis of water samples, plus preparation of data and evidence.

Effecting the actual clean-up measures after conferences and hearings is also a gradual process. Municipalities must make engineering and financial studies; provide financing which usually requires bond issue elections; secure bids; and let the contract. Industries must determine if they can more feasibly pay for use of municipal treatment facilities or build their own. All of this takes time. For example, the conference under the Federal enforcement procedure concerning the Mississippi River at St. Louis was held March 4, 1958. Complete pollution abatement facilities are scheduled to be put in operation by January 1, 1967—a period of almost nine years. Cost of the total cleanup effort in this metropolitan area, including a number of outlying communities and industries, is estimated at $150 million.

The Federal enforcement procedures to date affect these rivers: The Animas of Colorado and New Mexico; the Bear of Idaho, Utah and Wyoming; Big Blue of Nebraska and Kansas; the Colorado and its tributaries, involving seven states; the Columbia of Oregon and Washington; the Corney Drainage System of Arkansas and Louisiana; the Mississippi (St. Louis area) involving Illinois and Missouri; the Missouri (areas of the two Kansas Cities, Omaha, St. Joseph and Sioux City) involving Iowa, Kansas, Missouri, Nebraska and South Dakota; and the Potomac, involving Maryland, Virginia and the District of Columbia.

Financial Assistance to States

Many difficult problems have been imposed upon the States in recent years as a result of rapid population and industrial growth. While some States have found it possible to expand their programs to meet growing needs, many others have been unable to do so. In 1956, for example, only 23 of the State water pollution control agencies were spending as much as $50,000 per year on their programs, and seven were spending less than $10,000.

To assist the State and interstate agencies to establish and maintain adequate pollution control programs, the 1956 Federal Act provided for grants to help meet the costs.

State and interstate water pollution control programs have used the program grants in a number of ways to strengthen their operations through employment of needed technical and other personnel and purchase of special laboratory and field equipment. These added resources have permitted the agencies to conduct more pollution surveys, accelerate their enforcement programs, improve their public information and education activities and institute research. Continued Federal financial support of State and interstate water pollution programs appears essential to consolidate and build upon the gains stimulated by the grant program.

Construction Grants To Aid in Treatment

The Federal Water Pollution Control Act is best known to the general public through its construction grants authority. This is the section which provides Federal aid to State, interstate, municipal or inter-municipal agencies to assist in meeting the costs of building sewage treatment plants. Individual grants cannot exceed $250,000 or 30 percent of the estimated project cost, whichever is smaller. Annual appropriations of $50 million up to a total of $500 million were authorized in the 1956 legislation. For fiscal years 1957 through 1960 a total of $185 million has been appropriated.

New legislation passed by Congress but vetoed by the President early this year would have increased

to $90 million the annual appropriation ceiling; however, the original authority of 1956 still holds. Congress may still appropriate up to $50 million a year if it sees fit to do so. This year Congress voted $45 million for this item in the 1961 budget.

To facilitate multi-municipal projects, HEW this year recommended that the act be amended so that two or more communities may pool their respective individual grants to build a single sewage treatment plant to serve the communities jointly. Another recommendation asked that construction grant funds might be reallocated from one State to another when, within the fiscal year, any State finds itself unable to use its allocation.

Under the construction grants program a total of 2156 projects were approved through June 30, 1960. They are located in every State of the Union, Puerto Rico and the District of Columbia. Of this total, 682 projects are under construction and 1031 are complete. They represent an expenditure of local funds amounting to $864 million and of Federal funds of $180 million. Thus the ratio of local to federal funding is nearly 5 to 1. Grant-supported sewage treatment projects are now being placed under construction and completed at a rate of 500 per year. The average project serves 14,700 people and costs $480,000. The average grant has been $83,000.

Projects approved to date will provide adequate treatment for municipal wastes from an equivalent population of some 20 million, reducing municipal pollution in over 21,000 miles of streams and along many miles of lake and ocean shores.

Over 70 percent of the projects involve construction of new sewage treatment works. Their completion will mark the first time that 50 percent of these communities have ever treated their sewage, and in 20 percent of the other communities, existing inadequate plants will be replaced by new ones. The remaining projects involve necessary improvements to existing sewage treatment facilities.

The stimulating effect of the Federal construction grants program is shown in part by contracts awarded before and after Public Law 660. During the five-year period 1952-1956 preceding the grant program, contract awards for sewage plant construction averaged $222 million per year. During the first three years of the grant program, 1957-1959, contract awards averaged $363 million—an increase of $141 million per annum. Though this represents a 64 percent rise, the total is still a long way from the $600 million that figures indicate is necessary to catch up and keep up with municipal pollution. Right now the number of persons served by sewers continues to increase faster than the number served by sewage treatment facilities.

Sewage treatment works have a low priority in the mind of the average voter. Schools, parks, playgrounds, streets and water works are tangible needs which every citizen can visualize and support. Even collecting sewers are recognized necessities since new home building must usually await their installation. Unfortunately most voters and tax payers see only the people downstream benefiting from sewage treatment.

Need for Improved Public Financing

There is serious need for improvements in State laws governing the financing of waste treatment works, as well as for State assistance in such financing. Needed also is legislation which will permit the various communities comprising a metropolitan region to work together effectively and equitably toward an integrated regional approach to common water and waste disposal problems. One-fourth of our present metropolitan centers cross State boundaries. Legislation is needed to effect interstate cooperation and programming in these areas.

In addition to the Federal grants program, several States now provide substantial financial aid for sewage treatment plant construction. If more States were to enact such aid supplemental to the Federal program, construction levels might be expected to rise proportionally.

Unfortunately, some State laws lack clear guidelines and controls in financing of publicly-owned utilities. Many are too restrictive with respect to debt limits and requirements for electoral approval. For example, the two-thirds majority required on bond elections in some States often results in public works issues being defeated by very small margins.

Although most States have liberalized and clarified their public financing laws over the past 30 years, none can be held up as a model. Improvements are still needed, including further simplification and liberalization to meet present conditions which are substantially different from those of even 20 years ago. It may also be necessary for the Congress and States in general to consider legislation dealing with the financing of industrial waste treatment works, as some States have already done.

Industry in the Picture

There are more than 150,000 water-using manufacturing establishments in the United States. An estimated 25,000 discharge their liquid wastes directly to streams. The others discharge through municipal sewer systems. Rough estimates in the Public Health Service place the pollutional discharge to water courses from these 25,000 as far greater in total volume and strength than the wastes from those industries discharging through municipal systems. Unless industry steps up its waste control and treatment facilities, its pollution may be expected to increase commensurably. Available data indicate that industry is accounting for but 13.3 percent of the national expenditure for research in water supply and pollution control.

Financial incentives to stimulate the building of waste treatment facilities by industry have been considered for a long time. Rapid tax amortization for the expenditures by industries for waste treatment to control pollution has been a subject of public discussion for 15 years. Factors involved are the desire to ease the financial burden incurred by firms as the result of treatment plant construction, and the desire to provide an inducement for them to undertake such projects.

At least three States—Wisconsin, Virginia and North Carolina—have laws providing for rapid amortization for waste treatment costs. In none of these States do the pollution control authorities regard the legislation as significant in attaining pollution control objectives.

Most economists agree that rapid tax amortization can provide some inducement to investment under certain conditions. The extent of the inducement is difficult to measure. In regard to waste treatment facilities, the element of uncertainty is larger because treatment facilities are not revenue producers—rather they are a process cost. Because little is known about current annual expenditures for such construction, the effect on the Federal revenues as well as the amount of increase in industrial waste treatment construction is difficult to estimate.

Photo courtesy of the Allegheny County Sanitary Authority

● **COLORFUL brick construction and new concepts of plant design distinguish the Pittsburgh project.**

Development and Design Features of the Pittsburgh SEWERAGE PROJECT

J. F. LABOON

Executive Director and Chief Engineer
Allegheny County Sanitary Authority,
Pittsburgh, Pennsylvania*

FOURTEEN years ago the Board of Commissioners of Allegheny County, within which the City of Pittsburgh and 128 other municipalities are located, incorporated the Allegheny County Sanitary Authority under the Municipality Authorities Act of 1945 for the purpose of providing sewage collecting and treatment facilities on a county-wide basis to meet the requirements of the 1937 Pure Streams Act as amended in 1945 for stream pollution abatement.

Twenty-one months later a report with findings and recommendations was published and distributed to the 102 municipalities (including the cities of New Kensington and Arnold located in adjoining Westmoreland County) which at that time possessed public sewer systems and thus were subject to State orders to abate stream pollution. The 102 municipalities had previously executed agreements with the Authority for the preparation of the study and report. The report recommended the construction of a central 185 mgd sewage treatment plant and the immediate construction of 156 miles of intercepting sewers at a total cost of $82 million.

Another 18 months passed before it became evident that the proposed county-wide program would not be accepted by the group of municipalities. Only four municipalities had signified sufficient interest to pass necessary legislation authorizing the execution of long-term agreements with the Authority for sewage service. It was then that the City of Pittsburgh, among those desiring to meet the problem, stepped into the picture and authorized the Authority to prepare a study which would provide service to the City at the lowest possible cost. The City stipulated that other municipalities could be included in the plan provided the cost of serving them would not increase the cost of sewerage service to the City. This meant that such included municipalities would provide sufficient revenue in the form of sewage charges to finance the extra cost of the extension of the intercepting sewers and all other increased costs of construction and operation resulting from the enlargement of the basic system including the sewage treatment plant. As of the present, 71 municipalities have executed long-term agreements with the Authority. Long-term agreements also have been executed with 28 industries which were discharging wastes directly into the streams.

**Mr. Laboon retired from his position as Chief Engineer and Director on September 1, 1960, but has been retained by the Authority as a Consultant.*

Only 7 of the 71 municipalities involving three separate cases could not meet this condition. In one case, a total contribution of $450,000 was provided for by agreement to cover the extra cost of service to a rapidly growing community which at that time had no public sewers in the area to be served by the basic project. This municipality advanced $15,000 in payment for engineering costs and is paying quarterly the fixed charges necessary to retire the balance of $435,000. This is in addition to the established sewage charges now in effect and charged as customers are added to the system. In another case, a large industry and a municipality contributed $100,000 in cash for extension of service. In the third case, four municipalities and a County institution banded together in the so-called Upper Allegheny System and agreed to pay extra sewage charges on a zone basis in addition to the basic project sewage rates to pay off a $1,000,000 extension of the basic system financed by the Authority. In several other instances only parts of municipalities were included in the service area because the remainder would have required pumping or because they lacked public sewers and in the absence of an agreement to finance the cost of providing increased facilities for areas which are unproductive these areas were excluded. It is only fair to point out that the great majority of the long-term agreements with the municipalities were made more than ten years ago, before the great migration of the past-decade from the cities to Suburbia. Had this been anticipated by the suburban communities there is little doubt that they would have taken greater advantage of the Authority's service The remainder of the 102 municipalities included in the original study, among which are the cities of McKeesport, Duquesne, Clairton, New Kensington and Arnold, which failed to accept Authority service, have decided to build their own facilities, in every instance at a greater unit cost.

The new study and the cost of preparation of plans and specifications were financed by means of a $2,000,000 loan made by the City of Pittsburgh. This was in addition to a $500,000 loan previously advanced by the City during the preliminary studies, and a loan of $150,000 advanced during the same period by the Federal Works Agency. The Commonwealth of Pennsylvania later made a grant of more than $500,000 on behalf of all participating municipalities in aid of plan preparation. Up to this point, no other participating municipality had made any financial contribution to the project, and it is only reasonable to conclude that had it not been for the magnanimous gesture of the City of Pittsburgh, the other municipalities would have shown little or no interest in the project. All loans were repaid with interest from the first moneys received by the Authority from financing arrangements. The Federal Works Agency loan was interest free.

Nature of Municipal Authorities Under the Pennsylvania Act

The earlier Pennsylvania laws governing the establishment of municipal authorities were supplanted by the recodified Municipality Authorities Act of 1945, under which the Allegheny County Sanitary Authority was created.

This Act makes an authority a public corporation having a life of 50 years, and gives it broad and independent powers to acquire, construct and operate projects of many kinds, including sewers and sewage treatment works. Authorities are empowered to borrow money and to issue bonds, but not to pledge the credit or taxing power of the State or of any municipality, the only security for their bonds or other obligations being the revenue secured from the operation of their project.

Rates and charges for the use of an authority's facilities are fixed exclusively by the authority board, and the Public Utility Commission has no authority to interfere. Such rates and charges, however, must be reasonable and uniform, and are subject to the jurisdiction of the Common Pleas Court upon appeal by any person questioning their reasonableness or uniformity.

Authorities possess many of the advantages and powers of municipalities and are subject to similar restrictions. Authority property is not taxable and authority bonds are tax-free. Authorities have the power of eminent domain but they may not operate any project in competition with an existing private enterprise. All contracts for labor or materials in excess of $1,000 must be advertised and awarded to the lowest competent bidder. The Attorney General of the Commonwealth has the right to examine the books, accounts and records of the Authority. The authority under a 1947 Amendment may construct lateral sewers and charge their cost to property owners on a front foot basis upon agreement with any municipality.

Reorganization of the Authority

One of the stipulations contained in the agreement executed between the Authority and the City of Pittsburgh for preparation of plans and specifications and to provide for repayment of the loans advanced by the City permitted the City to name the agency which would assume the responsibility of constructing and operating the system. Upon completion of the plans and specifications, the City chose to continue the Authority but under a reorganized Joint Authority whereby the City would have the right to appoint three and the County two members to the board of five governing the Authority. Thus the participating municipalities other than the City obtained representation on the board indirectly by appointees chosen by the County. The new board, which serves without compensation, took over in March, 1955, and contracts for the construction of the project were awarded early in February, 1956.

General Design Features

The project as now constructed is designed to serve 71 municipalities with an estimated ultimate population of 1,500,000 in the year 2000. The present population of the service area is 1,200,000 or 75 percent of the total of Allegheny County within an area of 218 square miles, slightly more than 29 percent of the County total. However, only 1,100,000 are actually connected. The present equivalent population served is 1,600,000 based on suspended solids but only 1,100,000 based on BOD assuming the sewage meter readings are correct; 250,000 customers including commercial and industrial are now connected. The present treatment plant is designed to serve a population of 1,400,000 estimated for 1970. Design population values, however, are 10 percent in excess of the probability curve. The intercepting sewer system has been designed for an average per capita flow of 127 gpd. Dry weather weirings at 35 locations in 1947, representing a served population of 678,000, produced a total flow of 64.4 mgd, an average of 95 gpd per capita. Dry weather infiltration from weiring data was estimated to be 18,600 gallons per mile per day. This was determined by breaking down the weiring data into components of water usage and infiltration. Most of the sewers weired during this period were of the combined type. In fact, the great majority of the sewers in the City of Pittsburgh are of this type. How-

ever, it is an established fact that none of the existing sanitary sewer systems in any of the municipalities observed during the various testing periods is free from roof drains and similar surface water connections, even though prohibited by regulation.

All industrial wastes are accepted except such as past experience has demonstrated cannot be treated with success in a biological process. Prohibited industrial wastes by ordinance include pickle liquors, cyanides, phenols, copper, iron, mineral oils, free mineral acids, combustibles, chemical sludges of all sorts, septic tank sludges, etc. Pretreatment is prescribed for other objectionable industrial wastes.

Three large streams divide the County into major drainage basins, namely, the Allegheny, Monongahela and Ohio Rivers. Lesser but important drainage basins are served by Chartiers and Turtle Creeks.

The Intercepting Sewer System

When the Authority began its studies, all sewage and industrial wastes from communities bordering on the rivers were disposed of by discharge into the streams without any thought being given to pollution or to the extension of the sewer outfalls further downstream to avoid local nuisance. There were no intercepting sewers along the built-up river fronts. Such sewers now had to be constructed under next to impossible conditions. Only in small drainage basins were there any intercepting sewers to be found and these ended at the river front. Studies revealed that the most economical construction was a combination of open-cut work, where possible and tunnel work otherwise. The final program included the construction of 30.5 miles in tunnel and 38.5 miles in open cut.

The design of the system necessitated first a determination of the sewage flow and next the quantity of storm flow to be intercepted and the effect of storm overflows on the streams with respect to their ability to recover rapidly from the sudden influx of pollution at the points of overflow. Studies indicated that overflow resulting from the interception of storm flow to the extent of 250 percent of the average dry weather flow would not produce objectionable conditions in the rivers and that regulation of such overflows was practicable. Further studies indicated that double-orifice type overflow control chambers could be used to advantage in all cases except those where flow into tunnel intercepting sewers was by means of vertical shafts. Automatic tipping gates were used for the latter condition. The final design incorporated 99 double-orifice type diversion structures and 148 diversion structures equipped with automatic unbalanced leaf-type control gates arranged to intercept 250 percent of the average DWF for a calculated 15-minute run-off period. As the storm flow and the head on the opening increase, the gate is tipped to a restricted opening which is calculated to reduce the intercepted flow to the rate of 150 percent of the average DWF. A few of the diversion structures are equipped with single orifices where conditions permit. The practicable minimum sizes adopted for the double-fixed orifices are 8 inches by 6 inches rectangular, and 6 inches in diameter circular. Their control of flow is limited to a practical minimum of 0.25 cfs. A total of 321 sewer outfalls were connected to the Authority system.

Pipe sizes and slopes were calculated by Kutter's formula for full flow, with coefficient of $n = 0.013$. In a few minor instances the pipes were calculated to flow with surcharge.

Design capacities were based on tributary population for the year 2000 at a rate of 90 gallons per capita average daily flow representing domestic and commercial sewage plus estimated wet weather infiltration at the rate of 25,000 gallons per mile of sewer, to which were added industrial wastes to make an average for the whole system of 127 gallons per capita daily for the year 2000.

To the average daily flow thusly determined, a contingency factor was applied, varying with the population and distance from the point of connection with the main intercepting sewer or with the distance from the sewage treatment plant. This factor varied for large branch intercepting sewers from 3.5 at the upper end of the system to 2.3 at the lower end for a population of 80,000. The design factor for the tunnel intercepting sewer system ranged from 2.5 at the upper end to 1.66 at the treatment plant.

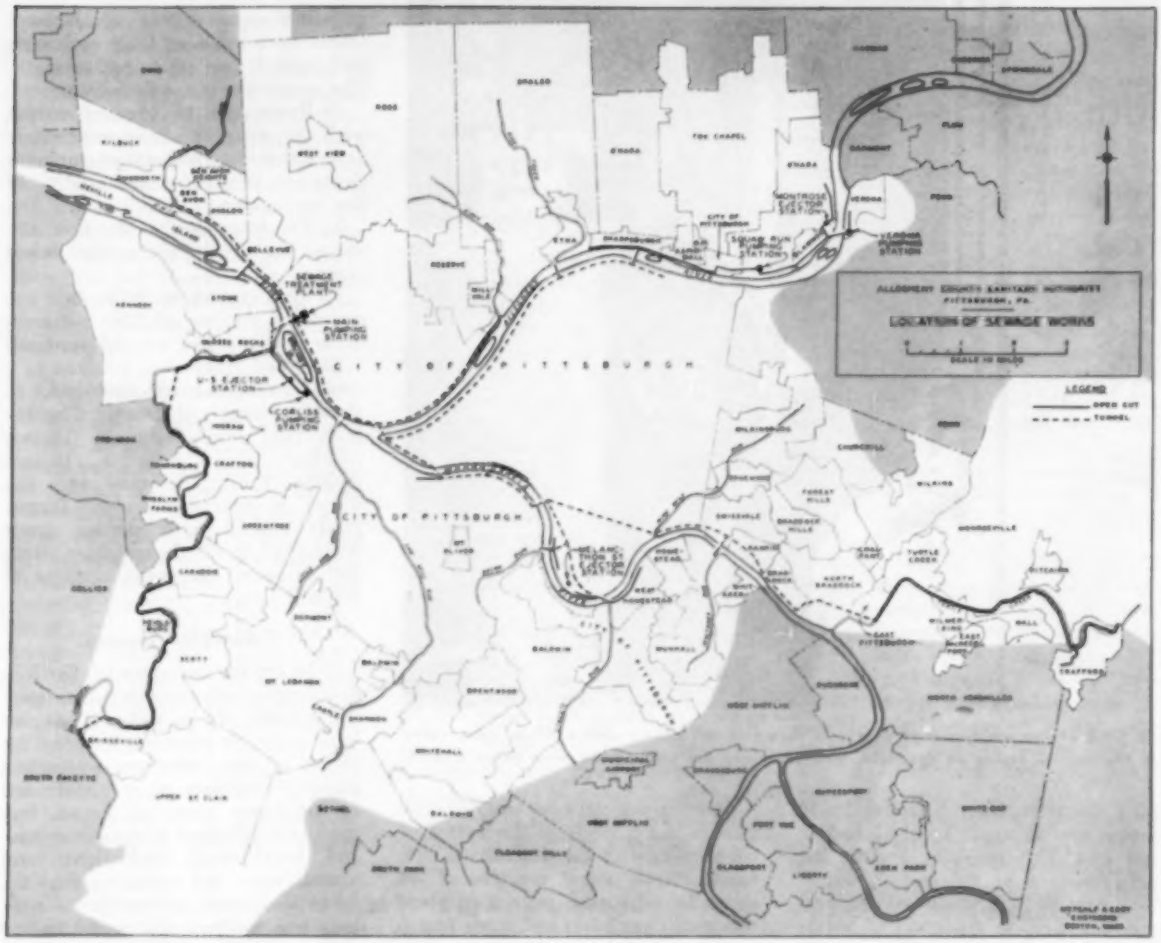
Grades for open-cut construction were established consistent with the slope of the streams in which the pipes were usually installed as a matter of necessity. There was no problem with respect to velocities since the stream beds were always steeper than the minimum grade required for non-settling velocities. Sewers in the tunnel required more attention due to the advisability of maintaining flat grades to avoid an impractical depth of the wet well and main pumping station. Other factors such as depth of rock below the surface, in which the tunnels were preferably located, and hydraulic considerations also had a bearing on the final result.

In addition to the control of intercepted flow by individual diversion structures, other controls of flows in the long branch intercepting sewers were located at the mouths of Turtle Creek (7 miles long) and Chartiers Creek (14 miles long) preceding their connections to the main tunnel sewers.

The master control at 11th Street, Braddock, controlling the Turtle Creek system, is located in a deep concrete shaft extending to tunnel level. An adjustable sluice gate installed at the bottom of the central dividing wall serves both as a control orifice and constant flow-through channel to permit grit and other bottom material to flow into the Monongahela River tunnel. Approximately one-third of the flow entering the tunnel will be by way of the adjustable sluice gate orifice. In addition to the bottom orifice, two fixed orifices are also located in the central dividing wall 30 feet above the sluice gate bottom, and just below the level of the overflow weir.

The Chartiers Creek master control consists of a 24-inch fixed orifice placed at the bottom of a deep manhole located 407 feet upstream from the tunnel shaft where the open-cut sewers connect to the tunnel system. A 36-inch overflow pipe, located 15 feet above the orifice plate, leads to the creek. A 30-inch sluice gate, located in the tunnel shaft ahead of the vortex chamber, may be used as added control to further limit the intercepted storm flow. Present experience gives every indication that the 24-inch orifice will need to be reduced to 18 inches for proper control.

The intercepted storm flow at these master control points is finally controlled by the level of the wet well located at the pumping station into which the three major tunnels connect. By raising or lowering the level of the wet well, the hydraulic gradient of the entire tunnel intercepting sewer system may be raised or lowered correspondingly. Its slope will be adjusted thusly to produce the desired rate of flow, and thereby control the intercepted flow into the sewage treatment plant. To permit such control, the tunnels are oper-



● **SERVICE area of the Authority is outlined by the shading. Main intercepting sewers were built as tunnels along banks of Ohio, Allegheny and Monongahela Rivers. Branches, constructed by opencut methods, follow Chartiers and Turtle Creeks.**

ated as a submerged system with the normal operating level in the wet well maintained at an elevation which is 73.5 feet above the invert of the main 126-inch tunnel. With this arrangement the saving in power required for pumping is estimated to be $135,000 annually. The wet well is pumped down weekly to a level approximating the invert elevation of the 126-inch tunnel sewer to relieve the system of all grit and other material which may have been deposited during periods of low flow. The velocities during the pump down reach a calculated maximum of 4.4 fps.

Local pumping stations have been installed at three points and ejector stations at three other points in the intercepting sewer system. All are automatic operation. The Corliss Pumping Station, with two 6-mgd pumps and the largest local station in the system, is equipped with a comminutor because of its isolated location on the Ohio River, reached only by boat.

The most difficult problem to solve was the design of the downshafts by which sewer outfalls are connected to the tunnel system. Nowhere in technical literature was there to be found any data on the design and construction of deep shafts to accommodate vertical flow. A few isolated cases of such shafts employed stepped inclined flow but these were too costly. Therefore, an arrangement was made with the Carnegie Institute of Technology to employ its hydraulic laboratories to conduct a series of downward flow tests on glass models. The results were most enlightening. The tests produced the following conclusions:

1) Tangential flow into a chamber set atop the vertical shaft was necessary.

2) A vortex type chamber would best meet the requirements for smooth flow.

3) The throat in the vertical shaft must be properly shaped.

4) Relief must be provided for air entrainment.

Formulae were developed for the relationship between depths of flow and velocities and for the geometry of the vortex chamber. The ultimate design produced a spiral flow in the downshafts. The tests were made by Dr. Louis M. Laushey, then Professor of Hydraulics, under the direction of Dr. F. T. Mavis, then Director of the Department of Civil Engineering.

Later, another series of tests was made at the laboratories of the Authority on a similar model to measure air entrainment in the downshafts under various conditions of flow. These tests were made by H. A. Thomas, retired Professor of Hydraulics at Carnegie Institute of Technology, with the assistance of Authority personnel.

Both research projects were confirmed in actual operation of the completed system. There has not been a single instance of failure in this regard.

The final design included 122 downshaft connections ranging in

Photo courtesy of the Allegheny County Sanitary Authority

● **ONE of the main sewage pumps is shown in the center and a 48-in. gate valve in the suction piping on the right, located in the dry well of the main pump station.**

pipe diameter from 8 inches to 36 inches and in depth from 37 feet to 168 feet. The majority are in the neighborhood of 100 feet in depth. The two 36-inch shafts constructed are designed to transport a maximum flow of 46 mgd. The vortex chambers are constructed integrally with the diversion chambers in every case.

An important consideration in the design of the vortex chambers was the matter of wearing qualities. High velocities in the chambers required concrete quality highly resistant to erosion. As the result of accelerated erosion tests made in the Authority laboratories on various pipe materials, it was decided that the vortex chambers should be precast using only the most durable aggregates and concrete cured with steam and water under controlled conditions, similar in quality to the concrete liner pipe discussed later herein. The vortex chambers were cast in steel forms thus producing a tough and smooth skin for durability and smoothness of flow. The downshafts were drilled through a steel casing usually 12 inches greater than the diameter of the downshaft. The downshaft was made up of wrought iron pipe, placed inside the casing. The 6-inch annular space between the casing and the wrought iron pipe was backfilled with concrete.

To minimize the possibility of erosion in the tunnels at the points of connection with the downshafts, the intersections were constructed as specially shaped, poured-in-place concrete chambers, and were paved with tough, dolomite limestone paving blocks, 5 inches wide, 12 inches long and 6 inches deep, laid in cement grout.

Considerations of long life for the tunnels prompted the adoption of precast liner pipe in place of an integrally poured concrete lining.

The problem of providing concrete liner pipe for the tunnels having qualities highly resistant to erosion caused by grit carried in combined sewers required special attention. With this in mind, a series of accelerated erosion tests was conducted in the Authority laboratories by the late William J. Geary on concrete pipes made with various aggregates and by different manufacturing processes and on clay and asbestos cement pipe. The tests were made with a sand blast using standard Ottawa sand in all cases. The most effective angle of the blast was determined and adopted as a standard. It was found that the quality of the skin of all types of materials possessed properties of resistance to erosion beyond any anticipation. After the skin was broken through, erosion was much more rapid and in some cases highly accelerated. Cores were removed from each pipe and tested for crushing strength. The conclusions reached were:

1) Resistance to erosion varied with the strength of the concrete.

2) Crushing strength of concrete depended largely on the quality of the aggregates.

3) The more perfect the skin, the longer the life before erosion takes place.

4) That erosion would be best resisted by the use of 7000 psi concrete cured under careful controls.

Steel end rings were adopted as a standard for all concrete pipe in sizes 24 inches and greater. The 24-inch pipe was made in 12-foot lengths — larger sizes in 16-foot lengths. Infiltration thus was reduced to practically zero. Diaper joints poured with cement grout were used to fill the exterior joints and to cover the metal surfaces of the end rings.

Telemeter System

Data on the behavior of the hydraulic gradient resulting from central control of the wet well at the main pumping station is supplied by means of ten indicating telemeters grouped together on a panelboard in the main pumping station immediately adjacent to the pump control benchboard. Red lights and alarms warn the operators that the level of submerged flow in the tunnels has reached the grade line of the maximum hydraulic gradient at strategic points in the system. At the master control points at Turtle Creek and Chartiers Creek, the indicators are set to reflect the overflow levels. A second transmitter at the Turtle Creek control point reflects the depth of flow in the tunnel on the downstream side of the overflow chamber. Local storms causing sudden rises of the hydraulic gradient with consequent overflow in the storm areas are immediately discernible at the pumping station. Accordingly the interception of storm flow can be regulated centrally at the pumping station by adjustment of the level of the wet well. Another important service which the telemeter system will make possible is to reflect the hydraulic gradient in the system during draw-down operations. This will be quite revealing and most interesting. Unfortunately, the telemeter system has been in successful operation but a short time during the past year because of difficulties with corrosion and saturated air which it is hoped will be resolved soon. The Chartiers Creek master control station, because of

its importance, is equipped with a recording flow meter.

Access shafts for the purposes of construction and entry to the tunnel system have been provided at Belmont Street, Mendota Street, 36th Street, South 8th Street, Four Mile Run, Nine Mile Run, Morningside and Glenwood in addition to the master control stations for Turtle Creek, located at 11th Street, Braddock, and for Chartiers Creek, located in McKees Rocks. The telemetering stations are located at these shafts.

The Main Pumping Station

The main pumping station located at the Sewage Treatment Plant houses not only the sewage pumps, but also a circular wet well 40 feet inside diameter and 118.5 feet deep below the main operating floor. Each foot of depth of the wet well approximates 10,000 gallons. At normal operating level the capacity is 750,000 gallons, equivalent to 7 minutes storage at the design average DWF of 150 mgd. The wet well is separated from the annular pump well by solid walls rising to a point above the roof of the main building thus providing complete isolation except for a connecting door at the main operating floor level. The circular well is equipped with fixed louvers which extend above the roof of the building to provide convenient exit for gases and vapors. A circular crane inside the wet well provides means for removal of large objects which may reach this point via the intercepting sewers and also provides for adequate maintenance otherwise, including the removal of floating grease when occasion demands. An adequate ventilating system facilitates removal of dangerous gases. Facilities for installation of a bulkhead for each pump suction have been provided for purposes of maintenance and future additions.

The sewage pumps are located in an annular dry well formed by the walls of the wet well and the outside walls of the pumping station. The overall inside diameter of the pumping station is 94 feet. The depth of the dry well is 112 feet between operating floors. The dry well is approximately 50 percent open at the top.

The size and number of sewage pumps were determined by several factors—1) the quantity of storm water interception producing maximum flow; 2) the design dry weather flow; and 3) the flow requirements for draw-down. It is obvious that pumping heads and quantities to be pumped would vary with these changing conditions. The normal total dynamic head has been calculated to be 39 feet whereas under draw-down conditions the TDH is estimated at 106 feet. To provide pumps to meet these conditions was a difficult task. The present installation consists of five Worthington 36-inch pumping units, three with two-speed, 1250/450-hp synchronous motors and two with 400 rpm, 800-hp synchronous motors and variable speed magnetic drives. A float-switch of special design prepared by Worthington has been installed for automatic control. The two-speed units have a rated capacity of 50 mgd each at 39 feet TDH and 277 rpm and 50 mgd at 106 feet TDH and 400 rpm. The variable speed pumps have a rated capacity of 50 mgd at 39 feet TDH, 50 mgd at 78 feet TDH and 11 mgd at 106 feet TDH, each at full speed.

During weekly draw-down, which begins early Saturday evenings and extends over a period of 10 hours when the flow is low, the three two-speed pumps provide a total capacity of 142 mgd at a TDH of 113 feet when the wet well level reaches the elevation of the invert of the 126-inch tunnel. All five pumps operating at submerged wet well level produce a total of 275 mgd.

Space is provided for a sixth pump which is already on order. A short circuit in the 1250 hp motor of one of the two-speed pumps last winter caused by a most unusual mechanical accident, made it impossible to effect an adequate draw-down for a period of three months. This situation resulted in a build-up of a five-foot blanket of heavy grease in the wet well which ultimately had to be removed by improvised means with the help of the circular crane. The variable speed pumps should not be used for pump-downs at a TDH greater than 91 feet for practical reasons due to the severity of service, thereby the burden was placed on the remaining two two-speed pumps which were inadequate for the purpose. As a consequence, a fourth two-speed unit has been ordered and will be installed shortly.

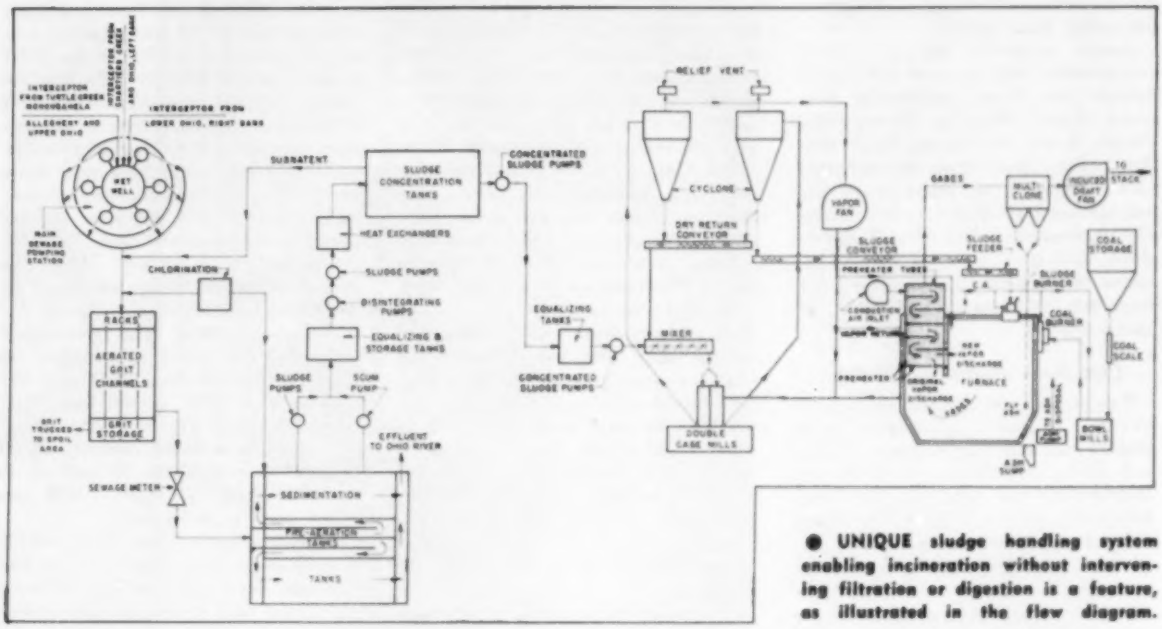
A drainage pump with a capacity of 4 mgd was installed in the dry well for unwatering the wet well during construction and repairs and in case of flooding of the dry well when the sump pumps may prove inadequate.

The dry well is equipped with mechanical ventilation, elevator, stairs and telephone. The walls are painted cream color, the bottom floor red, the pumps yellow, and the stairs jade green.

Hydraulic gate valves with con-

● **SIX sedimentation tanks are 280 by 30 by 15 ft. and provide a two-hour detention period at 150 mgd. The average unit surface loading is 1,350 gpd per sq. ft.**

Photo courtesy Link-Belt Co.



● UNIQUE sludge handling system enabling incineration without intervening filtration or digestion is a feature, as illustrated in the flow diagram.

trols located on an operating table at top operating floor level are installed in the suction lines leading to the pumps. Automatically operated syphons have been installed in the discharge lines thus eliminating the need for gate valves.

The Sewage Treatment Plant

The sewage treatment plant is located on the Ohio River within the borders of the City of Pittsburgh, 3 miles downstream from the Gateway Center or Point as it was formerly called. The facilities consist of pre- and post-chlorination, mechanical racks, aerated grit chambers, magnetic flow meter, preaeration tanks, sedimentation tanks, sludge and scum pumping stations, blowers, heat exchangers, sludge concentration tanks, sludge disintegrators, incinerators, ash lagoons and maintenance buildings. Facilities have been provided in the Administration Building for billing and collecting sewage charges.

The plant has been designed for an average DWF of 150 mgd and permits of extension to 185 mgd for estimated requirements of the year 2000. The present plant hydraulically will pass a flow of 300 mgd.

The sewage from the pumping station, which is equipped with overflow weirs as well as a backwater gate for gravity overflow in case of power failure, is delivered to four Link-Belt mechanically cleaned bar racks having a clear opening of 1 inch. The screenings are drained, transferred to garbage cans and disposed of in a sanitary fill, privately operated, located approximately two miles from the plant. The author is a firm believer in the theory that materials removed from sewage permits of 100 percent disposal and therefore should not be returned to the raw sewage for only partial removal. The method used for disposal of screenings in this plant is complete and most economical. The Rack Building is pressurized against escaping gases and odors.

Chlorine is applied to the sewage ahead of the racks for pre-chlorination. Provision has been made for application of chlorine in the influent channels of the sedimentation tanks as post-chlorination. The chlorine facilities consist of four Fischer & Porter machines, each with a daily capacity of 6000 lbs. Space has been provided for two additional units. The chlorine machines are located in a room completely isolated from the rest of the building and from the adjacent chlorine control room.

The screened sewage then passes on to four aerated grit chambers equipped with Walker Process type spargers. Grit is removed by a clam bucket operating from a monorail and transported to grit storage hoppers, one for each grit chamber, where the grit is drained and stored preliminary to hauling to a dump site located about 1¼ miles away. The original design provided for discharge of ashes from the incinerators and boilers to the grit storage hoppers, but due to the fineness of the incinerator ash this arrangement was abandoned. Ash lagoons have been improvised in an unanticipated manner by excavating the slag fill from the coal pockets which were constructed many years ago on the site. The cost of providing this facility by excavation was less than $13,000. Air for the grit chambers is designed for a rate of flow of 5 cfm per lineal foot of chamber. Deflectors to break up short circuiting have been provided at the entrances since operations began.

The sewage leaving the grit chambers is collected into a single conduit and passes through a 72-inch magnetic meter on its way to the two preaeration tanks.

The preaeration and sedimentation tanks are divided into two batteries, with the preaeration tanks located in the center. The preaeration tanks consist of two channels each, designed to provide a total detention period of 44 minutes at the average rate of flow of 150 mgd. Air facilities are designed to provide 7 cfm per lineal foot of channel. Walker Process spargers are used for distribution of air. Facilities presently are being installed to permit removal of grease balls which collect in large quantities at the end of the first channel. A weir with beachplate and connecting piping for transportation of the grease to the scum tank is being installed to avoid awkward removal by means of a fork as is presently done. Slide gates are now being installed at the end of one channel in each battery to permit by-passing the sedimentation tanks. The by-passing arrangement was improvised last October when the

incinerators were closed down because of odor difficulties thus necessitating also a closing down of all raw sludge producing facilities. Three Roots-Connersville blowers supply 6000 cfm each.

Two batteries of rectangular sedimentation tanks, each consisting of three tanks and four channels per tank, are equipped with Link-Belt drag-type longitudinal conveyors for collection of sludge and scum. Screw-type cross conveyors transport the sludge to the sumps from which the sludge pumps take their suction. Scum is collected on the return pass of the scrapers and delivered by means of revolving squeegee-type skimmers to scum troughs leading to a central sump. The sedimentation tanks are 67 feet by 280 feet in plan and have a detention period of 2 hours at the design flow of 150 mgd. The weir overflow rate is 35,500 gallons per foot per day, average. The unit loading is 1,350 gpd-sq ft.

The sludge and scum pumps have a capacity of 350 gpm each at a TDH of 40 feet. They were specified with constant speed motors which have since been replaced with variable speeds. Effluent water connections were recently installed in each of the raw sludge suction lines to dilute the raw sludge to a concentration of 9 percent to permit successful pumping. The pumps are Wemco. A magnetic flow meter was installed in each of the two raw sludge lines but the results are disappointing.

Raw sludge is pumped to a holding tank forming part of one of the ten sludge concentration tanks. Each concentration tank is 30 feet by 105 feet in plan and has a capacity of 325,000 gallons. From the holding tank, one of the two Sulzer disintegrators delivers the shredded sludge to the Marlow pumps which deliver the raw sludge through the heat exchangers, where it is heated to 95°F, and then to any one of nine concentration tanks. The heated sludge remains in the concentration tank for five to six days after which the subnatant is withdrawn and returned to the raw sewage influent channel for treatment. The concentrated sludge is then removed by means of Link-Belt screw conveyors and delivered by Moyno pumps to one of the four daily sludge hopper tanks. Moyno pumps then deliver the concentrated sludge to the incinerators.

[The technique of concentration of raw sludge for disposal by incineration is a novel feature of the Allegheny County plant. It has been popularly termed the "Laboon Process."—Ed.]

The bottoms of the concentration tanks are hopper-shaped troughs, four in each tank, and equipped with longitudinal screw conveyors which deliver the concentrated sludge to a screw-type cross conveyor.

The vertical screws in the sludge concentration tanks, originally connected to the suction of a Moyno pump, have been removed and replaced with new connections to the pumps which now take their suction directly from the sludge sumps located in the tank bottoms. With this arrangement the Moyno pumps have presented no difficulties pumping sludge concentrated to 26 percent solids.

Ohmart sludge density meters have been installed recently in each of the two concentrated sludge lines leading to the daily sludge hopper tanks to indicate and record the density of solids in the concentrated sludge. Six additional meters of the same type are on order for installation in the raw sludge suction line of each of the six sedimentation tanks. Their performance has been good.

The four incinerators are the flash drying type of the Raymond Division of Combustion Engineering, Inc. Each has a capacity of 22,500 lbs. per hour of sludge concentrated to 18 percent solids. Two boilers, each with a heating surface of 6,160 square feet, are installed in the Incinerator Building to provide space heating for all buildings as well as steam for sludge heating. A 300-foot chimney, with an inside top diameter of 14 feet, serves both the incinerators and boilers. Coal handling facilities have been installed to supply supplementary heat to the incinerators for support of combustion. Gas is used to dry out the incinerators and to keep them heated when necessary.

The construction of the project was started March 1, 1956 and placed into operation on April 30, 1959.

The buildings are constructed of substantial materials throughout, making for low cost maintenance. The exteriors of the buildings are faced with ceramic glazed brick in colors of red, yellow, blue and gray. The Administration Building is air-conditioned.

The total cost of the project is shown in Table 1.

To determine the gross amount of the bond issue, other items must be added to the total cost as follows: Discount on bonds, $1,919,000; and advance for initial operating expenses, $1,000,000, making a grand total of $99,492,000.

To finance the work, $100 million of revenue bonds were sold in five issues.

The cost of the Sewage Treatment Plant is represented by the difference between $18,033,000, the total cost of the work done at the plant site, less $3,000,000, the total cost of the Main Sewage Pumping Station, or $15,033,000, which is equivalent to $100,000 per mgd.

Table 1—Costs of the Project

Report and plans and specifications 1946 to 1956	$ 3,179,000
Land and rights-of-way	1,763,000
Equipment	219,000
Construction—	
Intercepting System	64,500,000
Treatment Plant and Main Pumping Station	18,033,000
Engineering during construction	3,209,000
Administration during construction	874,000
Bond and Trustee expense	265,000
Interest on City of Pittsburgh Loan ($2,500,000)	235,000
Interest paid during construction	4,296,000
Total	$96,573,000

Sewage Charges

All costs of the Authority operations and funding of revenue bonds must be paid out of revenues collected through sewage charges which are based on the quantity of water used on the premises. Agreements were made with all municipalities, and with industries where necessary, principally to secure the collection of 100 per cent of the sewage charges and to permit the municipalities to choose between two methods of payment of sewage charges. In one, the lump sum method, the Authority calculates the bill for each customer and submits a totalized bill to the municipality for payment and in the second, the direct billing method, the Authority bills the premises directly. A num-

ber of municipalities chose the lump sum method. By this method they may rebill the customers for sewage charges at increased prices thus providing the municipalities with additional revenues for maintenance of their sewerage systems. This method is a necessity for uniform application of charges where one part of the municipality is served by the Authority and other parts are served by other agencies at different rates. The agreement provides that delinquent accounts shall be paid by the municipalities in return for liens which the municipalities may file against the delinquents. An Act was passed by legislature permitting the shutting-off of water supply of delinquents for non-payment of sewage charges. The security of collection of delinquent accounts provided for in the long-term agreements permitted the Authority to sell its bonds at optimum interest rates.

The agreements with the municipalities and industries also provide that credit water, that is, water that does not reach the sewerage systems may be deducted from the sewage bill provided the customer installs approved metering facilities for measuring such water. Where sewage flow is sufficiently great, industries in some instances have installed approved sewage meters. This is permissible under the agreements. A householder desiring to obtain credit for water used for lawn sprinkling may install a meter for this purpose with the approval of the Authority. A number have done so.

The present schedule of sewage charges is designed to produce a total of $9,500,000 annually, of which $7,100,000 is required for amortization of the revenue bonds and the remainder of $2,400,000 is for operating expenses of the system. The Bond Indentures require a 40 per cent coverage which means that $2,000,000 thusly collected is in effect a surplus which may be used to retire bonds at dates earlier than those provided for in the bond indentures. It is anticipated in the absence of future capital expenditures that the bond issue on this basis will be retired in a little more than 20 years at which time the sewage rates must be reduced to provide only sufficient revenue to meet the operating expenses. An Act passed in 1953 provides for annual State grants to all municipalities having constructed sewage treatment facilities since 1937 in the sum of 2 percent of the cost of such facilities. The Act of course is dependent upon sufficient appropriations for the purpose. The current appropriation permits grants approximating 1¼ percent. Such grants may be used to offset operating expenses or for retirement of bonds. When the bond issues are paid off and should the 2 percent Act be continued to be appropriated at its present rate, the cost of sewage charges may average as little as 25 cents per month per family based on present costs.

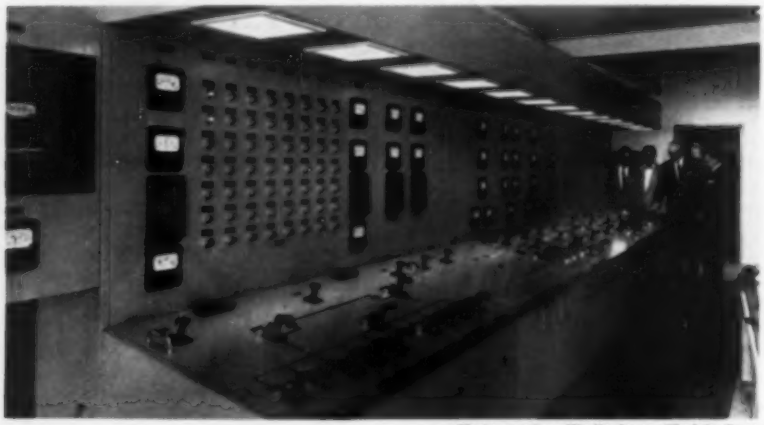


Photo courtesy Westinghouse Electric Corp.

● **MAIN control board installed in the pump station centralizes control of the incoming power feeders and pump motor speeds. It also indicates alarm conditions.**

The schedule of rates designed before construction began, after one year's experience, is yielding sufficient revenues to meet Authority obligations. The basic rate schedule is as follows: If the amount of water used per quarter is 100,000 gallons or less, the sewer service rate is 30 cents per 1,000 gals.; for the next 1,000,000 gals., 25 cents per 1,000 gals.; for the next 2.5 mg, 20 cents per 1,000 gals.; all over 3.6 mg, 15 cents per 1,000 gals. The minimum is $2.50 per quarter.

A surcharge is applicable to industrial wastes possessing excessive chlorine demand, BOD and/or suspended solids characteristics. Household garbage grinders are charged 50 cents per month. Commercial garbage grinders are charged at the rate of $25 per horsepower per quarter. A penalty of 5 percent is added to delinquent accounts.

Acknowledgments

The present Board of the Sanitary Authority consists of Edmund S. Ruffin, Jr., Chairman, Julius E. Graf, Vice Chairman; Richard B. Tucker, Jr., Secretary; John E. Connelly, Treasurer; and David Olbum, Assistant Secretary-Treasurer. J. F. Laboon was Executive Director and Chief Engineer until his retirement on August 31, 1960. J. J. Olliffe, formerly Administrative Assistant, became Executive Director on September 1, 1960, and L. M. Gentleman, formerly Deputy Chief Engineer, became Chief Engineer on September 1, 1960. R. A. Lincoln is Construction Engineer; R. J. Moran, General Superintendent; and H. J. Dickman, Maintenance Engineer. R. J. Dougherty, who left the Authority recently, was Chief Construction Engineer during construction and later General Superintendent. Mr. Moran, who succeeded Mr. Dougherty, was for many years Chief Chemist. Mr. Dickman was Resident Engineer during construction of the Sewage Treatment Plant and Main Pumping Station. Metcalf & Eddy of Boston have been Consulting Engineers since 1947 and designed the Sewage Treatment Plant and Main Pumping Station and the intercepting sewers along Chartiers Creek and Turtle Creek and in addition the open-cut portions of the Ohio River intercepting sewer. The late Frank L. Flood was partner in charge, and was succeeded by Edwin B. Cobb. The Authority engineering staff designed the tunnel system and the balance of the open-cut intercepting sewers. Celli-Flynn of McKeesport, Pa. were retained by Metcalf & Eddy for reviewing the architectural planning at the plant in regard to materials, colors and exterior and interior appearances. Philip S. Miller and Associates of West Orange, N. J. were consulting engineers on problems dealing with tunnel construction; E. D'Appolonia Associates of Pittsburgh were consultants on soil problems; and Thompson & Lichtner Co., Inc. of Boston were consultants on concrete problems, especially concrete pipe.

MORE WATER FOR THE KEYS

● **NEARING the US mainland, the Keys Aqueduct follows along the Overseas Highway on a bridge of its own through an area of deep canals and mangrove thickets.**

THE LONGEST drink to be found anywhere on South Florida's Gold Coast is the Florida Keys Aqueduct, an amazing fresh water lifeline that stretches 135 miles from mainland well fields to Key West. Running south and westward alongside the Overseas Highway, the seagoing pipeline carries 5.5 million gallons of water a day to some 50,000 residents in the Keys and Key West, whose existence is absolutely dependent on the supply.

There is no natural fresh water source anywhere in the Florida Keys, and until the Aqueduct was completed in 1942 it frequently became a long time between drinks. Historically, rainwater was captured in home cisterns, some of which are still in operating condition. But during the dry season rainfall averages only a little more than an inch a month. Seawater infiltrated the shallow wells, and deep wells produced water that was undrinkable because of its mineral content.

Installed jointly by the U. S. Navy and the Florida Keys Aqueduct Commission, the present 18-inch line was intended primarily to serve military installations at Key West. Except for the first few miles while it is still on the mainland, the line is mostly above ground. It takes to the air to cross water, either on its own trestles or attached to the Overseas Highway bridges. During World War II the entire length was patrolled by armed sentries.

In the past 10 years, with increasing population thousands of new connections have tapped the pipeline. Customer establishments range from ramshackle weekend fishing camps to plush, air-conditioned hostelries with fresh water swimming pools. So great has become the demand for service that the Aqueduct Commission expects this year to begin construction of another line along the same route. Designs have already been completed by Rader and Associates, Miami engineers and architects, for a new 20 to 24-inch new line which will carry up to 10 mgd.

Already built and in operation are three diesel-powered pumping stations which are units of the new designs. They were finished last January and currently are being used to increase the flow of water through the present line until the new one can be completed. Also in operation are two 5-mg storage tanks on Stock Island, each of which is 43 feet high and 140 feet in diameter. Along with seven others along the route, they serve as reservoirs to draw from as pressure fluctuates.

If the Aqueduct Commission is able to work out financing on schedule, there will be 19 miles of new line in service by 1962, and the whole project will be finished by 1967. A new well field also is in the program and the eventual overall expenditure will be $24 to $25 million.

Ernest A. Ramsey, who has been manager of the Aqueduct Commission since it was formed, controls a far-flung water system with customers along the entire 135-mile route of the line. Although the price of water to these consumers is higher than in the Miami area, it is less than in some other locations in this country where the water supply is less precious. "When we obtained our first loan to finance construction of this Aqueduct, it was forecast that we would have a maximum of 3,000 meters hooked up to the system," Mr. Ramsey recalls. "The Commission now has more than 11,000 private customers and we are adding more every day."

Although it has never happened, Keys residents have always been concerned about being left high and dry should there ever be a break in the Aqueduct. However, the area could be served for a week to 10 days without any water coming through the line from the well field. "We might have to ration customers by dropping the pressure," Mr. Ramsey adds.

The 1950 census gave the Keys 30,000 people, of whom some 26,000 lived in Key West. By 1958 the population of Key West had jumped to 43,000, which prompted forecasters to predict a population of 70,000 within the coming 30 years. The current U. S. census ought to produce the first really reliable measure of the corresponding growth of the Keys.

● **PIPE LINE is attached directly to highway bridges for long distances. This viaduct once carried a railroad track.**

● **HOUSE service lines may be over water instead of under ground. Aqueduct is only source of fresh water in the Keys.**

Basically, the original agreement reached by the Aqueduct Commission, which was created by the Florida Legislature in 1941, and the Navy still stands, although there have been various changes meantime. The Navy agreed to construct a fresh water supply system to serve the Keys if the Commission agreed to contribute a third of the costs of construction, major repairs and replacements. In return, the Commission was to receive at least a third of the water—except during periods of national emergency—in the succeeding 50 years. The first water from the mainland flowed into Key West homes in October, 1942, and it has been flowing ever since. But the area mushroomed in population to an extent that was never predicted. Navy air and sea facilities expanded during the war; the discovery of jumbo shrimp in the Keys water brought on a sort of latter day gold rush, and tourists who came to visit stayed to live.

By 1947 the Aqueduct was operating at capacity, and in 1953 a new pumping station was added to increase the rate of flow. Already visualizing a time of water shortage the Commission, in 1956, retained Rader and Associates as consulting engineers to plan to provide an additional supply. After exhaustive economic and engineering studies, the engineers recommended construction of a new water system to include additional wells in the same area—near Florida City, southernmost mainland city in the U. S.—a larger pipeline, a new water treatment plant and the already mentioned pumping stations and reservoirs. The new line will follow the route of the present one along the Overseas Highway. Salt spray above ground and salt water below the surface constitute a special problem in locating the line.

SEWER MAINTENANCE ORGANIZATION FOR A COUNTY

Extract from a paper by C. R. Velzy, Husbaumer, Clarke & Velzy, Consulting Engineers, at the 1960 meeting of the American Public Works Association.

AN EXAMPLE of a modern well organized and operated sewer maintenance department is that of Nassau County on Long Island. Under the leadership of A. Holly Patterson, County Executive, and Charles V. Smith, Commissioner of Public Works, the County is just completing a program of installing some 1000 miles of sewers, including trunks and collection systems, and has established an effective maintenance organization. The organization has grown with the construction program. It provides a definite schedule of preventive maintenance.

The maintenance department has headquarters in its own building which houses the main office, garage, store room and machine shop. Operating from this headquarters are eleven flushing crews, seven cleaning crews, two pumping station maintenance crews, and two construction crews. Each flushing and cleaning crew has a truck specially designed and equipped for its particular duty. The other crews are similarly equipped.

At the main office there is maintained a complete set of record drawings of the entire sewer system and a card index of every section of the sewers. On the card index is kept a record of every inspection, flushing, and cleaning operation. Thus, there is a history of every foot of the sewers showing where attention is needed and the nature of the problems that are likely to require attention.

An interesting and useful feature of the equipment of this department is the two-way radio system installed on all cars and trucks. With this system a call received at the County Building or at headquarters can be immediately communicated to the crew which should service the call. This provides prompt response to any emergency.

At Nassau County preventive maintenance is the objective, and the department has been organized with this in mind. The program provides for inspection, flushing and cleaning of every section of the sewer system once each year, and more frequently on those sections on which the records show the need. With this schedule, excellent service from the sewer system has been maintained, and complaints because of stoppages in the sewers have been practically eliminated. This department has established an enviable record, and is without doubt, one of the best organized and operated maintenance departments in the country.

EFFECTIVE CONTRACT RELATIONS WITH CONSULTANTS

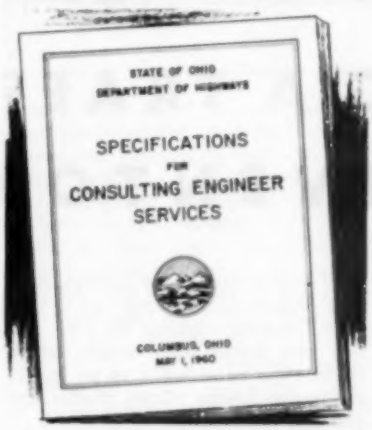
ROBERT W. MEYER
Executive Assistant of Metropolitan Expressways
Ohio Department of Highways
Columbus, Ohio

THE PROVISION of effective contract relations with consultants is a problem which, with few exceptions, must be faced by public works agencies at all governmental levels right down to the smallest areas of local jurisdiction. As our population grows and shifts, the provision of public utilities and buildings, adequate streets and highways and mass transportation facilities present increasingly important and complex problems.

Most public work agencies are not adequately staffed to cope with these additional burdens; or, in the time available, to lay out and evaluate a master analysis of precisely what the problems are and what they are likely to be in the relatively near future. This concept may at first appear to be so elementary that it is glossed over with the thought that the problems are known and it is the solutions that are perplexing. This may well be the biggest mistake of all; and, from this erroneous initial assumption, subsequent efforts often prove ineffectual and the problems compound themselves at an alarming rate.

Evidence of how important an analysis of the over-all problem can become is demonstrated by a review of the National Conference on Highways and Urban Development held in October, 1958. Among several Conference objectives, these goals were expressed: 1) To improve mutual understanding among the various classes of officials and specialists responsible for highway and urban development; 2) to suggest how the necessary professional talent and technical skills can be mobilized to execute the highway and urban development program within available time limits; and 3) to obtain agreement on inter-governmental responsibilities, with a view to improved relations.

Among the Conference findings and recommendations for state, local and joint consideration, one declaration especially supports a strategic attack on the over-all problem: "All



levels of government should strengthen their support of city and regional planning. All federal agencies dealing with urban development should continually review their policies to achieve coordination with state and local objectives in urban development and transportation."

Following the approval of a master plan, the special problems of financing, design, construction, maintenance and operation befall the public agency staffs; but special talent often must come from other sources. Certain problems are encountered only once, or are cyclic in nature and it would be neither desirable nor economical for the public agencies to expand their forces to meet them. Many complex technical problems also may require special abilities and techniques. Public works organizations may not always be able to attract or retain personnel qualified to perform these functions.

Therefore, it appears inevitable that more and more consultants must be retained in the future and effective relationships must be established between the owner and the consultant in order to obtain adequate results in the most expeditious and economical manner.

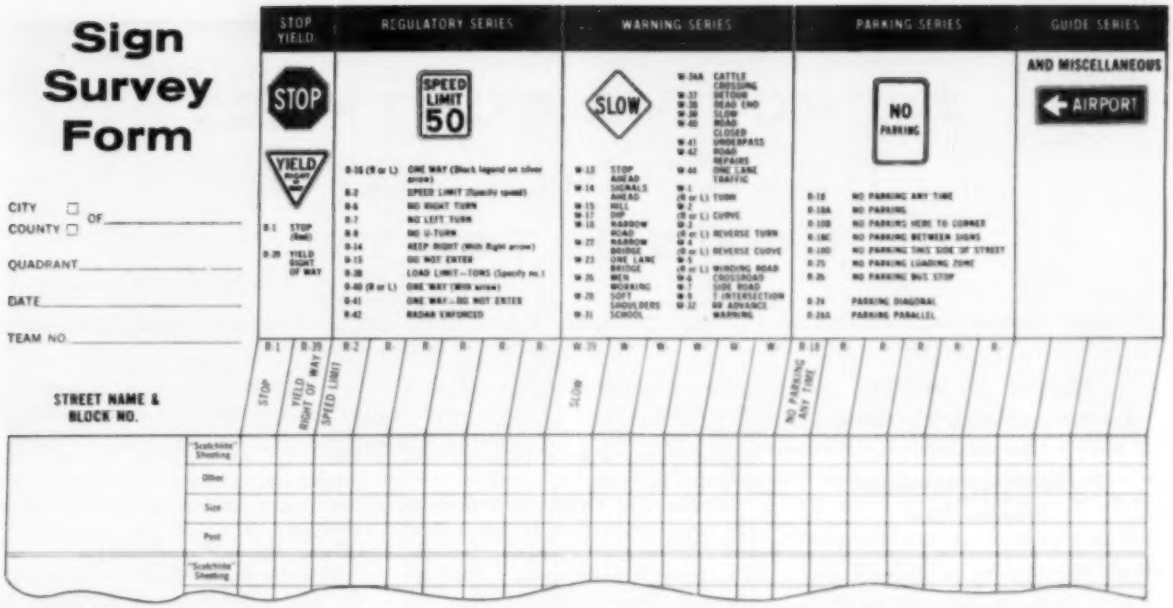
The development of specifications for the performance of the work is probably the most important single contribution to the initiation, prosecution and successful conclusion of any project. This is true in view of the fact that the owner must know precisely what he wants, and in what sequence, in order for anyone to evaluate, organize and specify the type and quantity of work to be performed. These same prerequisites are of critical importance in specifying effective contract relations with consultants. Their preparation requires broad experience and insight into the legal, technical, and administrative relationships.

First, it is improbable that a public agency will be charged with a single project which, when accomplished, forever discharges its obligations. More probably those obligations will require many projects in which certain elements are similar or repetitious in nature. Second, there are certain elements which are peculiar to the performance of work by consultants. Finally there are certain technical phases of any work which should be isolated for financial and other control.

Specification Format

The Ohio Department of Highways' "Specifications for Consulting Engineer Services" provides an excellent example of the maximum isolation of specification variables from the specification constants. The first two sections are devoted primarily to those items which are of great importance to the contract relationships between the owner and a consultant performing any portion of the overall task.

(*Continued on page* 203)



● FORM shows code or identification developed for making traffic sign inventory to determine existing and future needs.

MAKING A TRAFFIC SIGN INVENTORY

GARY M. CHAMBERLAIN
Research Assistant to the City Manager, Iowa City, Iowa

IN JULY, 1959, under the direction of City Manager, Peter F. Roan, Iowa City began a comprehensive survey of all street signs. The object of this survey was to establish a program for refurbishing and maintenance of existing signs, as well as providing for any future sign installations and planning.

The survey was conducted with three major criteria in mind:

1) A comprehensive survey was to be made of all street signs; and to classify them as to size, legend, whether reflectorized or non-reflectorized, and general condition.

2) From the above information, it was to be determined which type of sign should be reflectorized, which type of sign should be changed in size and/or design, and which type of sign needed refacing or new blanks.

3) The final objective was to determine the existing and future sign needs. With this information the city could then facilitate bulk purchasing of materials and supplies at a considerable savings, provide standardized signs on a uniform basis throughout the city, and use and revise the survey which could then be enlisted as an aid in preparing future street, traffic and parking ordinances.

In order that a comprehensive survey could be made, certain procedures had to be worked out before the study got underway. The first step was to set up a "code" of identification for each type or series of signs within the city. The code was based upon a classification system devised and recommended by the Minnesota Mining and Manufacturing Company, as outlined in its "Sign Survey Guide." The code involved assigning a letter classification for each series of signs e.g., R for regulatory, W for warning, and S for school, etc. A number classification followed the letter; this denoted a variation within a particular series.

After the coding system was established, a form or worksheet was devised to facilitate the field work necessary in carrying out the survey. Through trial and error, a form consisting of seven columns was drawn up. The columns carried the following headings: a) street, name of; b) sign, type of (by code letters and number); c) side of street (on which the sign is located); f) color; and g) condition.

A third step was to section the city into eight segments, according to geographic and land use patterns. The segments were traced in crayon on a map of the city. Using the segment method made possible full-coverage of the city without duplication of any area.

Because of the comparatively small size of Iowa City (population 34,900, 1960), it was believed that one surveyor could satisfactorily conduct the survey. Therefore, a fourth step was installed to test the above theory. This consisted of an experimental run in order to determine if it were possible for one man to cover and record data on both sides of the street at the same time.

It was found that on collector streets and in residential areas one man could easily cover and record data for both sides of the street in one trip. However major arterials required a different system.

In working out a plan for covering major arterials, it was decided

to stay with the one-man survey, but to have the surveyor go up one side of the street and then down the other. At the end of the street the surveyor could stop and combine both recordings on a single sheet. A consecutive record was kept which enabled work crews to locate later any sign within the city which needed replacement or repair.

The downtown area presented a different problem. Because of the congestion and multitude of signs located in the downtown area, the method of surveying was somewhat altered. It was found that one man could again survey both sides of the street during certain hours. Between the hours of 2 AM and 6 AM no parking is allowed in the downtown area. The surveyor, on foot, could adequately cover both sides of the street during the above hours. This avoided making either two trips or employing another surveyor, which would have been necessary during any other time period.

As each street was recorded by the surveyor, that street was marked off on the city map. Along with the segment method for recording signs, mentioned earlier, this provided a double check insuring no duplication of recording.

A rather sound principle the surveyor followed while recording the signs, was to start with the lowest numbers on a block and work up the street to the highest numbers. This entails a few extra miles; however, by recording data in this manner it was found that a job-plan for maintenance crews could be worked up. Such a record also provided for a more detailed and easily chartable survey analysis for administrative purposes.

The survey required about four weeks to complete. About 80 percent of this time was spend recording data on residential and collector streets, and about 20 percent on compilation of data and drafting of ordinances. Recording the arterials and downtown area took only two days using the alternative survey methods in data collection.

Looking back over the comprehensive survey, it was found there were 46 different types of signs in Iowa City out of a total of 2,132 signs. It might be well to go through some of the more prevalent types to see what a city can accomplish by using data gathered from the comprehensive survey.

There were a total of 232 stop signs within the city limits. A few of the combinations of stop signs formerly in existence were:

30x30	Red	Reflectorized	100
30x30	Red	Non-Reflectorized	3
24x24	Red	Reflectorized	52
24x24	Red	Non-Reflectorized	52
24x24	Red	Reflector Buttons	10
24x24	Yellow	Non-Reflectorized	15

In the first grouping none was found to be unserviceable. Most of them were new. In the second grouping the three signs were recommended for replacement. They were reflectorized in part; but the reflectorizing material had either faded or fallen off and could not have been seen at night. Only ten of the third group needed replacement. All of the signs in the fourth group needed replacing and were found to be faded and unserviceable. Reflectorization of all signs in this class was recommended. Most of the signs in the fifth grouping were in good condition. However, it was recommended these be replaced at the end of their serviceability for standardization purposes. Group six (yellow) signs are outdated and need to be replaced. They are hard to see at night and appear to be out of place with the newer red signs.

A final recommendation for signs in this series was replacement of 24-in. signs with 30-in. reflectorized signs on all arterials.

The check on no-parking signs showed a lack of uniformity. After completion of the survey, it was found there were signs within the same block which read: No parking; no parking this side; no parking anytime; and no parking this

How Iowa City Benefited From Survey

1. It was important to the city to know types of signs, the number of signs, and where each sign is located. This facilitated standardization, easy maintenance, and bulk purchasing savings.

2. It provided easily readable, uniform legends throughout the city. This helped in the enforcement of traffic regulations. The public became more aware of the signs and observed them, because they understood the legend.

3. Results of the survey were an important aid in drawing up parking, street, and traffic ordinances.

4. A reflectorizing program could be carried out, designating the types of signs which should be processed in this manner.

5. The city felt, because of the sign survey results, it would be beneficial to invest money in a sign face applicator. By using this device the city could stock the necessary blanks and faces which could then be used as the need arises. There would be no costly delays in repair, purchasing, and placement of signs. Bulk purchasing has more than paid for the cost of this applicator.

6. Formerly signs were purchased through one supplier within the State. Because of the uniform sign program, use of the applicator, and instant checks on present and future sign needs, the City can now receive bulk purchasing bids. Such purchases will meet the required specifications at the cheapest possible prices. For example, in regard to stop signs, the city purchased 30x30 red, reflectorized aluminum, octagonal blanks at a cost of $4.50 each from a state industry. For this same type of sign, through centralization of purchasing procedures, the city now receives bids as low as $3.70 each.

● **SIGN AT left is inadequate and does not conform in size with the majority of the other signs in the city. At right is a reflectorized standard NO PARKING sign.**

● **THIS SIGN is too low and the face is weatherbeaten, yet it might have gone unnoticed without a city-wide survey.**

side of street. These signs were of different sizes and colors and most were in need of repair.

From the above data came the following conclusions and recommendations for all of the no-parking signs: 1) Signs should be of the same legend; reading "NO PARKING AT ANY TIME;" 2) signs should have a standard size, 18-in. high and 12-in. wide; and 3) signs should have a white background with a red legend.

Standardization of no-parking signs has made the motorist more aware and observant; it has improved the appearance of the sign; and it has provided savings through bulk purchasing. This same conclusion can be drawn about all types or series of signs throughout the city, after sign survey data was processed.

AUTOMATIC CONTROL of Residual Chlorine . . . .

ATTMORE E. GRIFFIN
Staff Consultant, Equipment Division, Wallace & Tiernan Incorporated, Newark, New Jersey

A paper before Southwest Section AWWA, New Orleans, La.

THE KEY to successful chlorination is the amount, type, and persistence of residual chlorine in the water. The control of chlorine application to insure that the proper amount of residual is produced, to guarantee that the proper type of residual is present and to make sure that the residual will persist well into or throughout the distribution system constitutes the mechanism which operates this key.

That the amount of available residual chlorine present in water is of considerable significance was learned as far back as 1908. Analytical work at that time demonstrated that certain minimum residual chlorine values were necessary to keep the bacterial population within acceptable limits. This concept is just as important today as it was in 1908. It may perhaps be even more important because recent discoveries indicate that the type of residual present (free available or combined available) must be determined and maintained to achieve maximum results.

To meet these requirements of amount, type and persistence, chlorination must be carefully controlled. To do so manually presents an almost impossible situation because of the multiplicity of samples required. Not only must the chlorine be added at known and uniform rates but the amounts applied must be in proper proportion to the variations in flow and in accordance with the characteristics of the water. These requirements can now be met to a surprising degree of accuracy by combining mechanical, hydraulic or electrical principles with chemical and biological principles.

Automation can be said to have started with the development of the chlorinator itself. Basically, this is an automatic device because it accepts gaseous chlorine from a cylinder, equalizes the variations in pressure, meters the chlorine, mixes it with water and applies it at a uniform rate over protracted periods of time. It does this automatically without the need of constant watching or testing. The drawback is that unless the chlorinator is equipped with special devices it will continue to apply the chlorine at the same rate until the supply of chlorine fails or other conditions develop to interrupt the flow of gas. All changes in the rate of gas flow must be made by the operator. This is manual operation.

A step toward automatic control of residual chlorine was achieved with certain electrical devices so that the chlorinator would be stopped when the pump stopped and restarted with the resumption of pumping. This type of operation is semi-automatic or start-stop chlorination. It has the advantage of starting and stopping as the pumps

go on and off, without attention from an operator. It makes certain that chlorine is applied to all the water pumped, but does not take care of flow variations or changes in chlorine demand.

The development of devices to increase or decrease the amount of chlorine applied in accordance with the volume of water flowing past the point of chlorine application takes care of the flow changes and is called automatic chlorination. However, this still leaves unanswered the question of how to compensate automatically for changes in chlorine demand.

Some years ago, the orthotolidine colorimetric route seemed to be the most logical one to use to record the residual chlorine present. As a result, several colorimetric residual chlorine recorder systems were developed. However, the idea never became very popular and soon gave way to the amperometric system which has the advantage of being able to record either the total amount of residual chlorine present or the free available portion present; and is not subject to the interference that plague the orthotolidine system.

Amperometric Recorder

Thus, the amperometric residual chlorine recorder answered the question of recording residuals both in respect to amount and type. This development immediately opened the door to automatic residual chlorine control because once a record of the residual chlorine is made on a chart it becomes only a matter of linkage to convert this information into a form that will actuate a chlorinator to maintain a constant residual of the type determined by the operator.

The amperometric system of recording and controlling residual chlorine has received wide acceptance because the response to small changes in residual is rapid and because the recorder can be calibrated using a similar system, the amperometric titrator. In some instances the recorder is calibrated by means of the orthotolidine test. This method is not recommended largely because of the known interferences with the test. The O-T method has other weaknesses also, such as light source and errors in technique made by individual operators. This means that the results obtained by O-T may vary over a considerable range in relatively short periods of time. Thus, if the recorder is calibrated to O-T, it may be out of calibration an hour later, not because the recorder calibration has changed but because of interferences with the O-T method which result in erroneous readings.

The amperometric titrator and residual chlorine recorder are not subject to these errors. Once a calibration is made it will hold over a considerable period of time, usually about one week.

The development of this amperometric system for detecting and recording residual chlorine with precision as to amount and type was of tremendous importance in the sanitary field because there became available for the first time a dependable method for continuously doing a job that could not be done satisfactorily by manual means.

The jump to an infinite variety of controls was now a fairly simple procedure. Heretofore there had been no way to obtain the proper signal as to requirements. The amperometric recorder system put the signals on a chart. The rest was simply conversion of the information to forms to actuate remote recorders, indicators, alarm systems, and controllers.

Hypothetical Case

To illustrate what this means, when combined with previously developed stop-and-start, flow proportional or remote manual chlorine rate controllers, we will look at a hypothetical large water purification plant and system located in a highly industrialized area.

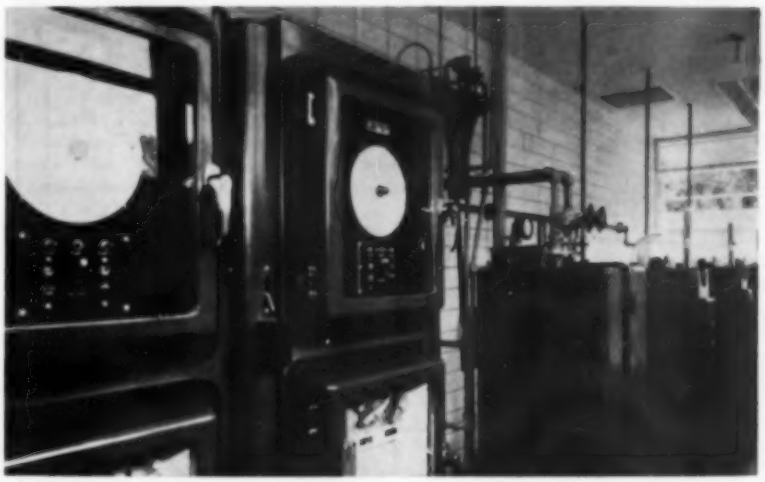
The population on the watershed approaches 1,000,000. There are upwards of 50 domestic sewage treatment plants in this area and perhaps 200 industrial waste treatment plants. Highways crisscross in a never-ending lattice work pattern. The water may not always be the best in the world but vigorous watershed control prevents major pollution so that the water can be used as a potable supply.

The treatment consists of pre-sedimentation, alum coagulation, sedimentation, and filtration. Various reservoirs float on the line; an auxiliary supply enters the system at the high lift pumps; and wells on the outskirts are used intermittently. Chlorination, in a case such as this, is an essential part of the treatment and by utilizing the devices now available for automatic chlorination control, the chemist in charge with a minimum of helpers knows what is going on throughout the plant and system regarding residual chlorine just as the engineer knows about his pumps, water flows or pressure.

This imaginary plant has a chlorine control center. In it are located residual recorders, residual indicators, stop-and-start signals, and remote manual chlorine rate controls covering every point of chlorination.

The control starts at the high lift pumps, Station No. 1. Since the water goes to a pre-sedimentation basin, start and stop of the individual chlorinators at each pump may suffice. These on-and-off cycles show in the control center in the form of lights. The rate of chlorine application may be changed by the operator by means of push button controls. If circumstances require it, a residual chlorine recorder may be installed at the influent to the pre-sedimentation basin with a "slave" recorder in the control center.

The next point of control is ahead



● **CHLORINATORS** *and residual recorders in St. Cloud, Minn. The amperometric residual recorder permits maintenance of a constant residual determined by operator.*

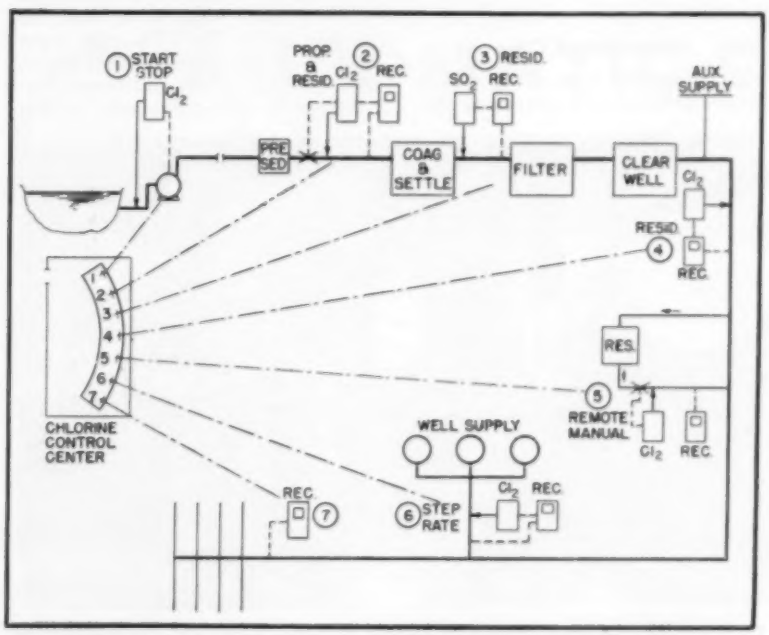
of the coagulation and sedimentation basin, Section No. 2. Here residual chlorine is a necessity and quite probably the controls must be set to obtain a given value of free available chlorine at high enough levels to carry a free available chlorine residual of perhaps 1.0 mg/L to the end of this basin, Station No. 3. The sample at Station No. 2 is collected as close to the point of chlorination as is consistent with good mixing, so that hunting may be reduced to a minimum.

Free available residual control is imperative in this instance to overcome tastes and odors and to obtain the greatest possible bacterial kill. Because the flow through the plant may vary over a rather wide range, the chlorinator should be equipped with flow proportional control plus residual chlorine controls.

At Station No. 3 the residual chlorine may be higher than is needed through the rest of the plant; or at this point chlorinous odors may be present in such quantities as to make uncomfortable working conditions within the plant. Regardless of the need for a lower residual, it can be obtained by automatic dechlorination. Sulfur dioxide acts rapidly and it is an easy matter to control the addition of sulfur dioxide so as to obtain a uniform residual.

Usually dechlorination is set to leave a residual that will persist through the filters, clear well, and into the distribution system. But our rather complicated waterworks has an auxiliary supply meeting the main supply ahead of the high lift pumps. This means another point, Station No. 4, of automatic residual chlorine control or, at the least, a recorder with duplicate remote recording in the control center where the operator may increase or decrease the application of chlorine by remote manual push button devices.

At the reservoir the situation may get somewhat complicated because of piping layouts. If it is a straight in-one-end, out-the-other-end system there will be few problems. In most cases, it will be desirable to add the chlorine at the inlet. Automatic residual chlorine control with flow proportional control will work well. Perhaps it will be necessary to chlorinate recirculated water with residual control or perhaps only the water leaving the reservoir can be treated, Station No. 5. Whatever system may be used proper tie-ins with the control center can be made.



● **HOW a chlorine control center works. Residual recorders and indicators, start-and-stop signals and remote controls cover every point at which chlorine is applied.**

A well supply in the past has been a problem to chlorinate properly without the necessity of constant attendance. Now, thanks to modern engineering and chemical know-how, such stations can go unattended for considerable periods. There are several hook-ups that can be used, such as simple residual rcording with remote control, automatic residual chlorine control or step-rate control. Sometimes the latter can be combined, Station No. 6. The individual needs will dictate the method or combination of methods to use.

Finally, there is the distribution system itself. With the complications previously outlined it would be good practice to have one or more residual recorders strategically placed for recording purposes only. Such installations, Station No. 7, will detect leaks or water intrusion from cross connections or difficulties near stand-pipes. Much stress has been placed on the usefulness of knowing quickly about drastic changes in residual chlorine to guard against sabotage.

It is not assumed that every water system should have all of the equipment discussed here, even though there are several places where more equipment is used than shown on this hypothetical system. It is assumed, however, that the majority of water supplies now using chlorine could profitably use one or more of the variants outlined. In many instances the use of some form of residual control will eliminate certain difficulties such as intermittent over or under chlorination and in others it will solve troublesome taste and odor problems. In most cases automatic chlorination control will help solve the manpower situation and will make it possible for the person in charge of the system to know at all times the amount of residual chlorine everywhere; he can instantly spot trouble that might otherwise go undetected over a considerable period of time. It all adds up to the general conclusion that automatic residual chlorine control will produce the amount, type and persistence of residual chlorine desired.

References

1. Cutler, J. W. & Green, F. W. "Operating Experiences With A New Automatic Residual Chlorine Recorder." *JAWWA* 22:755 (June 1930).
2. Marks, H. S. & Glass, J. R. "A New Method of Determining Residual Chlorine." *JAWWA* 34-1227 (August 1942).
3. Baker, R. J. & Griffin, A. E. "Development of Instrumentation in Chlorination." *JAWWA* 50-489 (April 1958).

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Cost of Refuse Collection

Based on 27,670 loads of brush, totalling 32,028 tons, and 282,467 tons of garbage, Fort Worth, Tex., estimates that it cost $5.69 per ton for garbage and brush collection in fiscal year 1959.

LATEX MORTARS

Show Promise In Pavement Repairs

PUBLIC WORKS engineers in general and highway maintenance engineers in particular are watching with great interest the many new product developments in the field of bonding and thin resurfacing agents for use on or with Portland cement concrete. One product that has shown promise and potential in this field is synthetic latex.

Synthetic latexes are polymer (plastic) particles dispersed in water. All commercial synthetic latexes are white milky liquids used in various surface coatings and impregnations. Latex mortars consist of conventional Portland cement, sand and water, plus latex which replaces a portion of the water. Defoamers, diethylene glycol, and other formulating ingredients are also often added. The latex modified mortar, although possessing handling characteristics similar to conventional unmodified mortars, has other properties which are improved, according to manufacturers. Because the latex appears to form a coating around much of the cement and aggregate, it imparts to the mixture elastomeric properties inherent to the latex and protects the cement from exposure to fluids to which the latex is resistant. Latex modified mortars are claimed to have increased bond, tensile, compressive and flexural strengths. Alkali and dilute acid resistance are said to be increased. Among the current producers of latexes are The Dow Chemical Company; E. I. du Pont de Nemours & Company; Monsanto Chemical Company; General Latex and Chemical Company; and Firestone Tire and Rubber Company.

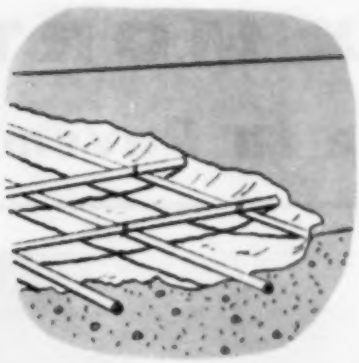
One of the best-documented experimental field placements of latex-modified mortar, to date, was that applied to a bascule bridge deck in Cheboygan, Michigan, during the fall of 1957. This work was reported at the 1960 meeting of the Highway Research Board when the paper, "Latex Modified Mortar in the Restoration of Bridge Structures," jointly prepared by S. M. Cardone and M. G. Brown of the Michigan State Highway Department and A. A. Hill of the Dow Chemical Company, was presented. The subject

● **WORKMEN in the background are brushing in a scrub coat of latex mortar while the crew in the foreground operates the strike-off bar to level the patch surface.**

structure, carrying U. S. Route 23 traffic, has a 40-ft. wide, four-lane roadway with two 5-ft. sidewalks. Built in 1940 with crushed limestone coarse aggregate, natural sand, and non-air entrained cement, the concrete deck surface was badly scaled from weathering and de-icing salts, and highly polished from the action of traffic.

The work done on the Cheboygan bridge included removal of the unsound and scaled surface with a cutting machine. Small air chisels and sandblasting equipment were used to prepare the patching areas. Narrow steel strike-off bars were greased and set with anchor bolts along the edge of each lane so that the proper depth (½-in.) of patch and crown of deck surface could be maintained. (These strike-off bars were removed after the patches had cured.) For purposes of evaluation, four different methods of treatment were used: 1) Surface thoroughly wetted before placing latex-cement mortar; 2) surface left dry and untreated; 3) bond coat of straight latex emulsion brushed into surface and dried until tacky; and 4) a latex-cement slurry at a ratio of 1:1 broomed into surface. The latex-cement mixes were made in a standard transit mix truck using a sand-cement ratio of 3:1 and a latex solids content of 20 percent based on weight of cement. Air entrainment was controlled by adding to the latex, 0.2 percent Dow Corning Antifoam B solids, based on latex solids. The thin-patch resurfaced areas were covered with wet burlap for 24 hours and then air-cured for six days before opening to traffic.

Subsequent evaluations of the patches showed that the areas where the mortar was applied over a sound wet substrate held up well through two winters. Bond failed during the first year in varying degrees in the three other types of treatments of dry, latex-emulsion covered or latex-cement-slurry covered substrate. These failed areas were repaired in 1958 using a different type of latex in the mortar applied over a clean wet substrate. The repatched areas appeared to be well bonded after one winter of observation.



All illustrations courtesy Dow Chemical Company

● **PROPER surface preparation is an important step in the successful placement of latex mortars. Loose, broken, scaled and dirty concrete should be removed in a thorough fashion and a minimum depth of ½ inch should be provided for the mortar. Cracks must be routed out to sound concrete. Exposed metal joints and rods should be cleaned by sandblasting. To assure a smooth, level surface for the patch, screed bars are placed on both sides of the patch area. The entire area is carefully cleaned with an air hose and kept moist for 24 hours before placement of the latex mortar surface patching.**

All latexes used were furnished by the Dow Chemical Co. The 1957 patches used a styrene-butadine copolymer designated as Latex 560, and the 1958 repatching employing a saran type of latex identified as X2130.

Based on the foregoing and other field applications, a detailed procedure for latex-mortar patching has been developed:

Preparation of Area to be Resurfaced

1) Concrete should be removed from perimeter of area to be resurfaced to maintain a minimum thickness of ½ inch and avoid feather edging.

2) All cracks should be chipped out to a depth of 2 inches. Holes should be chipped down to sound concrete. All loose stones and unsound portions of the roadway should be removed. All grease, oil, bituminous patching materials, dirt, etc., must be removed from the area to be resurfaced. The area should then be sandblasted and vacuumed (if possible). The day prior to resurfacing, the area should be thoroughly soaked with water. It should be kept soaked up until time of placement to minimize water loss from mortar.

3) Longitudinal, strike-off metal screeds should be secured every three feet on each side of the lane to be resurfaced. Counter sunk screws will prevent movement of the bars.

4) Headers should be placed over present transverse expansion joints to keep the expansion joints free of mix. When the headers are removed, the space will be filled later with expansion joint sealer.

Mortar Mixing Procedure

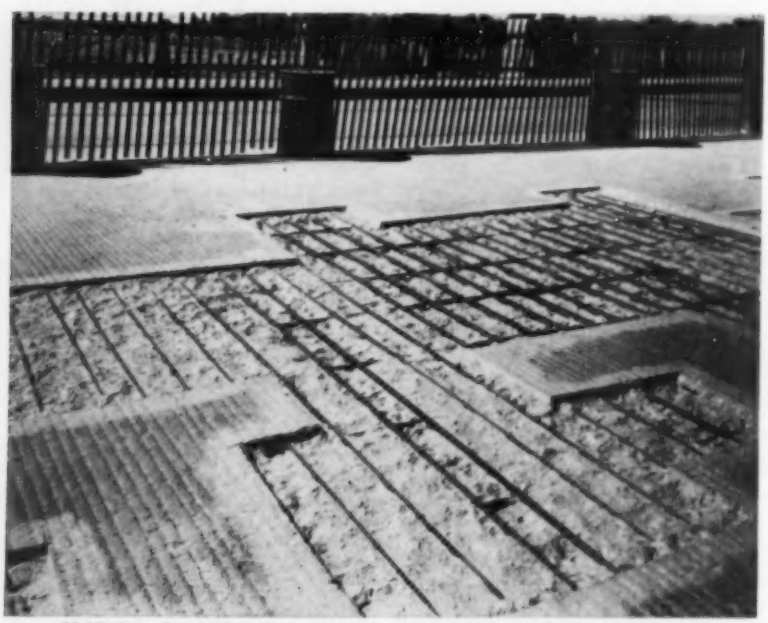
1) Add latex (containing antifoamer) and ½ of the water to the mixer just prior to adding the sand and cement increments.

2) Mix the latex mortar and add a sufficient amount of the remaining water to attain the desired slump. Total mixing time: 2 to 4 minutes.

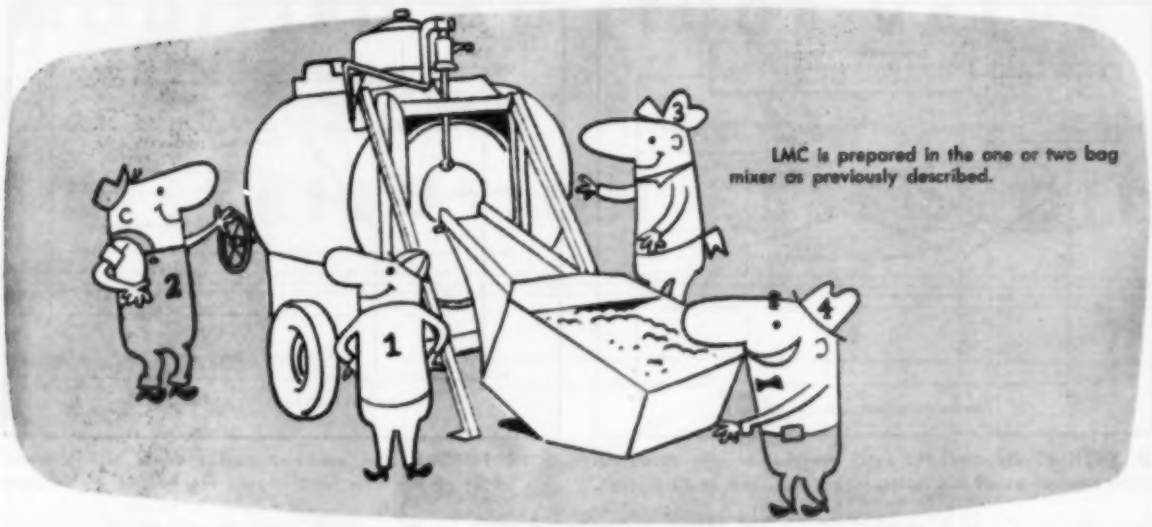
Application Procedure

1) Just prior to mixing the latex mortar, the area to be resurfaced should again be dampened with water. A portion of the latex mortar should be poured and brushed thoroughly into the substrate with stiff brooms. An excess of mortar should be maintained in front of the strike-off bar during the first pass.

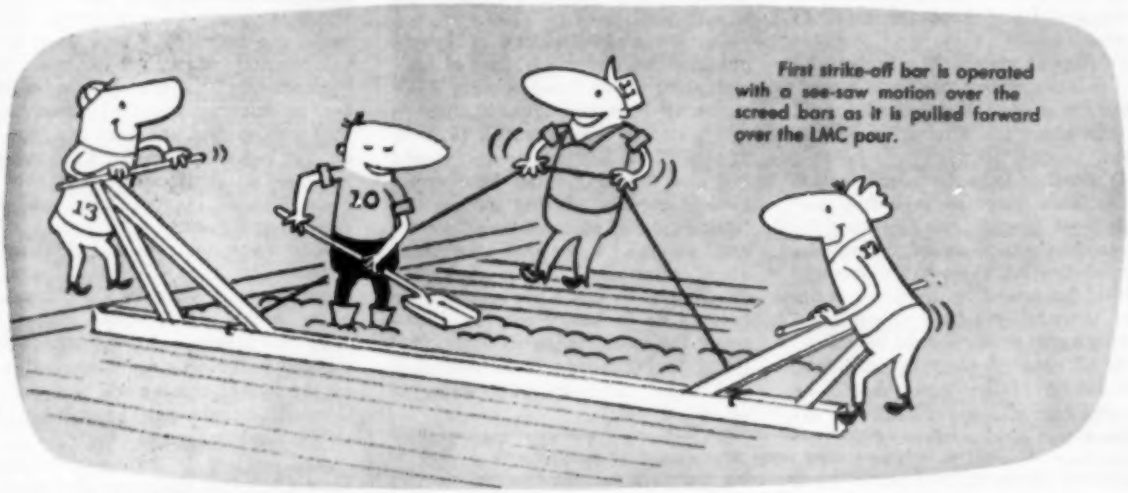
2) The first or rough strike-off bar is screeded over the freshly poured mortar in a sawing motion, carrying an excess in front of the bar. (The mortar should "puddle" rather than "drag" under the screed.) The area is screeded a second time immediately after the rough strike-off has been completed. The finished wear layer should be allowed to cure 10 to 30 minutes (depending on the weather) and then be covered with one layer of damp burlap. (The latex mortar should be covered when it has cured enough to support the weight of the damp burlap.) A second layer of



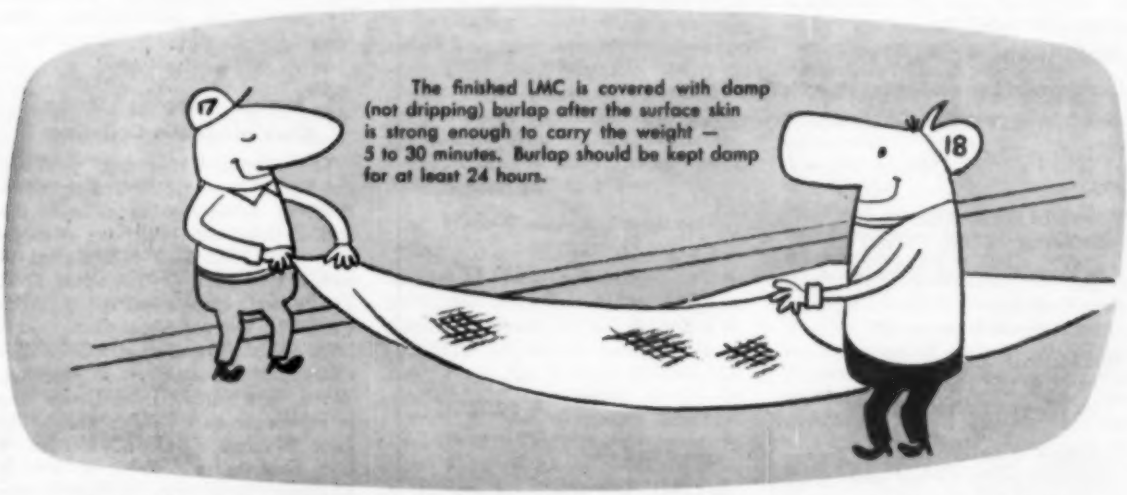
● **SECTION of a bridge deck which has been made ready for resurfacing. Area to be patched has cleanly sawed edges and is free from dirt and loose material.**



● **PLACEMENT** procedures start with the mixing of the mortar after preparation of the patch area.



● **POURING** and finishing the surface is preceded by covering substrate with a mortar brush coat.


The finished LMC is covered with damp (not dripping) burlap after the surface skin is strong enough to carry the weight — 5 to 30 minutes. Burlap should be kept damp for at least 24 hours.
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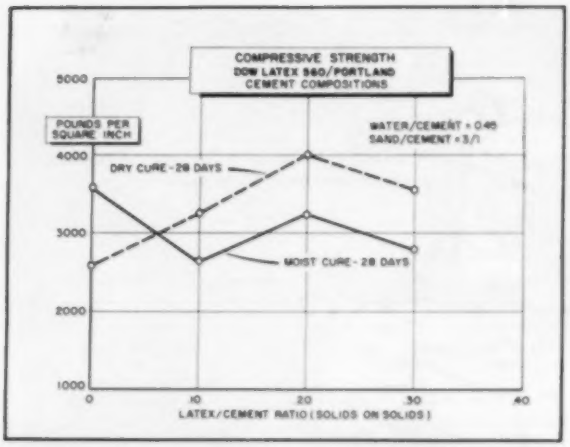
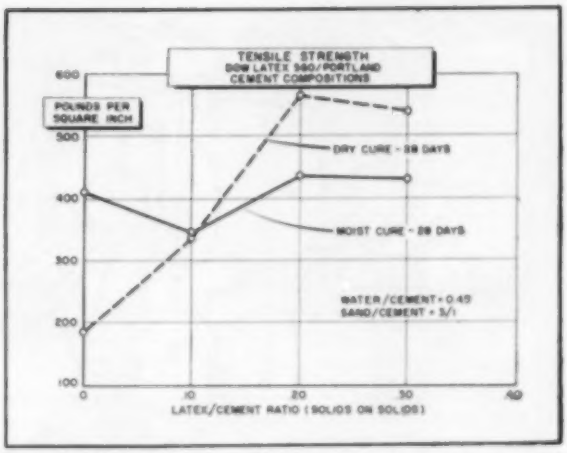
● **NUMBERS** identify workmen by assignment as shown in cartoon series published by Dow Chemical Co.



● **WITH air-dry cure, the latex modified mortar shows superior strength at all mix ratios, with a maximum at 20 percent.**



● **IN TENSION also, modified mortar shows high strength gain under air-dry cure with a max reached at 20 percent.**

damp burlap should be applied over the first layer approximately one hour later. The burlap should be redampened and kept moist for 48 hours.

3) Approximately 20 minutes after the latex mortar has been placed, the cutting edge of a trowel should be run along the screeds to release them.

4) Further to protect construction joints from water seepage and possible frost damage, one day after the burlap has been removed, the periphery of the latex mortar placement should be sealed with epoxy resin. The thoroughly mixed epoxy resin curing agent sealer should be poured over all exposed construction joints. An excess of dry sand should be poured over the epoxy sealer to assure a non-skid surface. (The use of epoxy resins could well be an article in itself. Suffice it to say that manufacturers' directions must be carefully followed.)

Certain characteristics of latex-modified mortars are worthy of special note: They have a very high slump (8-10 in.) at lower than normal water to cement ratios (0.35 to 1.0); working life is short so screeding and finishing must be accomplished rapidly; during curing the latex-modified mortars turn "green" but assume a normal "concrete grey" after final cure; placement should not be made during freezing periods or in heavy rain; and because the mortar adheres tenaciously to tools, mixers, etc., thorough and rapid clean-up with water is essential.

Manufacturers are continuing their research and experimentation in the field of latexes. Highway and public works agencies are placing test applications for evaluation. Because the material is still in a developmental stage no conclusive recommendations can be made. It can be accurately stated, however, that with careful adherence to proven procedures, Portland cement mortars, modified with latex, show great promise in many applications requiring a mortar with high bond and strength qualities and great resistance to the effects of wear, chemicals and weather. Its ultimate place in the public works industry will be determined only through objective research and evaluation by the manufacturers and the open-minded, imaginative reception of public works engineers.

Appreciation is expressed to the Dow Chemical Company and E. I. du Pont de Nemours & Company for their assistance in furnishing literature and illustrations from which this report was compiled.

Typical Latex Modified Mortar Formulation

Sand (2NS Type), lbs.	3000
Regular Portland Cement, lbs.	1000
Experimental Latex X-2144 (53% solids), lbs. (wet wt.)	283
Dow Corning Antifoam "B" (10% solids), lbs. (wet wt.)	4.5
Diethylene Glycol, lbs.	20
Water	As Needed
Volume of Formulation, cu. ft. (calculation includes 7% air)	33.9
Raw Material Cost of Formulation	$87.47
Area Coverage sq. ft. @ thickness of ½"	810
Raw Material Cost sq. ft. @ thickness of ½"	$0.105
Raw Material Cost sq. yd. @ thickness of ½"	$0.97

Costs based on January, 1960 price averages including sand (2NS type) @$2.04/ton; regular Portland cement @$0.94/sack.

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Sewage Pumping Station Uses Magnetic Couplings

The proposed pumping plant for the Venice Interceptor Sewer in Los Angeles, due for completion at the end of this year, will have a capacity of 76.2 cfs and is designed to handle the peak dry weather flow. The speed of the pumps will be varied by the use of magnetic couplings so that the sewage will be discharged at the same rate as received. When completed, it will be the largest raw sewage lift station in Los Angeles. Lyall A. Pardee is City Engineer and E. G. Studley is Engineer in charge of the Sewer Design Division.

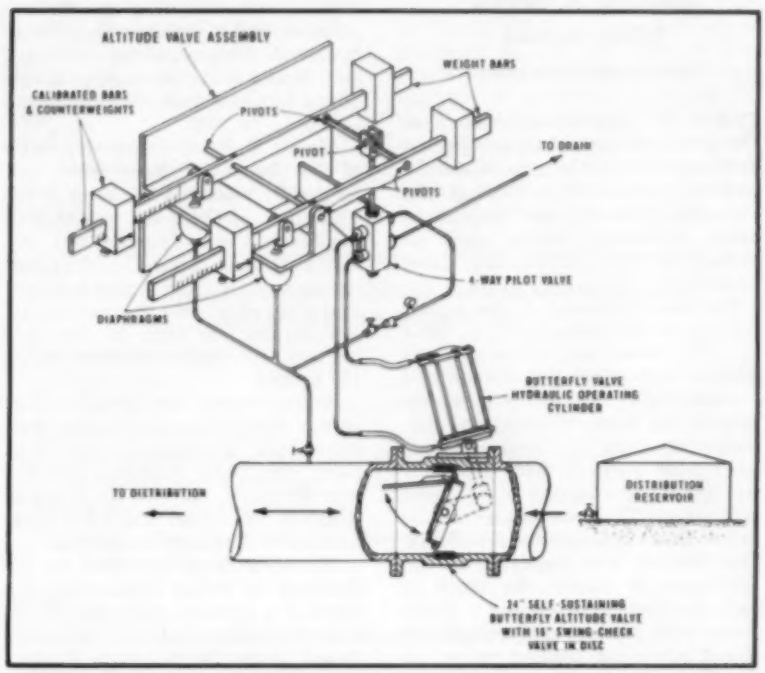
MODIFIED ALTITUDE VALVE CONTROLS DISTRIBUTION RESERVOIR

DONALD C. CALDERWOOD
President and Manager,
Pennichuck Water Works,
Nashua, New Hampshire

THE Pennichuck Water Works serves Nashua, New Hampshire, a town of 40,000, delivering a yearly average of 4.5 mgd. In the system is a 2.8-mg steel distribution reservoir to help supply water during time of peak flows. This tank was to be filled when the level dropped to a predetermined elevation. Filling was to cease when the level rose to a set point, and when the pressure in the distribution system decreased, the tank was to allow water to flow into the system to supply the demand. A B-I-F Industries, Inc., 24-inch self-sustaining butterfly altitude valve was chosen as the controlling unit for this tank.

The schematic diagram for this installation is shown in Figure 1. The usual action of this self-sustaining valve is as follows. With low pressure on the diaphragms, the valve is open. Thus the tank can be initially filled through the valve. As the pressure approaches within 2 to 5 feet (adjustable) of the desired closing setting, one diaphragm forces the weight and bar up—this cocks the 4-way pilot valve. When the set pressure is reached, the other diaphragm forces its weight and bar up and moves the pilot valve in a direction to close the butterfly valve. The reverse happens when the pressure drops. All opening or closing elevations in the tank are adjustable to within plus or minus 3 inches over a range of 15 feet by moving the calibrated counterweights on the parallel bars. In most installations the pressure to actuate the cylinder on the butterfly valve is taken directly from the pipe line. If required, however, the cylinder can be powered by an external source of water or air.

The operation of this particular valve is somewhat different from the usual action described above. Since this valve controls a flow from a distribution reservoir, not an elevated tank, the controlling pressure is only 20 psi. Therefore, the triggering takes place in one motion instead of the two motions described previously. Also in this case the band width is larger than usual, plus or minus 2 to 3 feet.



● **FIG. 1. Combination of swing check valve built into disc of butterfly valve permits control of reservoir level and maintenance of distribution system pressure.**

Time Delay A Problem

While this type of valve is satisfactory for most installations, in this particular case, due to the low operating pressure, 20 psi, it took 6 or 7 minutes for the butterfly valve to open when the pumps stopped. Of course, the time delay would be shorter if the operating pressure were higher. This time delay would cause up to a 10 psi pressure drop in the center of the city. The sudden pressure drop was sufficient to trip some of the automatic devices connected to the municipal fire alarm system, and the fire apparatus was answering false alarms at various industrial plants.

The solution to this problem was unique and effective. A 16-inch swing-check valve was built into the disc of the butterfly valve, Figure 1. The check valve opened instantly when the pressure fell and supplied water to the system while the butterfly valve was opening. By this simple technique, the advantages of an automatic altitude valve were combined with the continuous maintenance of distribution system pressure, and the need for a by-pass around the butterfly valve was eliminated. The system operates without any external power and has produced no operating problem in the nine months it has been operating.

A STUDY OF REFUSE COLLECTION and DISPOSAL SERVICE

MELVIN H. DIVEN
Borough Secretary
Mount Union, Pennsylvania

REFUSE DISPOSAL was first given official public recognition in Mount Union when an ordinance was adopted in 1910 prohibiting "the throwing of waste paper, sweepings, ashes, household waste, nails or rubbish of any kind into any street or alley."

The next reference in the public records to the refuse problem came in 1941 when an ordinance was adopted regulating the storage and transportation of refuse. Private haulers had been collecting and disposing of refuse for local residents for several years without any control until the adoption of the 1941 ordinance. This ordinance established an annual license fee of $10. The Burgess was required, by the ordinance, to inspect the truck of each applicant to determine if it was water tight and could be completely closed when not loading refuse, as specified in the ordinance. He was directed to issue a license if the truck passed inspection.

The problem was later covered in more detail by the adoption of another ordinance in 1956. This ordinance included the provisions of the previous ordinance for licensing haulers—the use of water-tight closed trucks; and storage of garbage in closed containers. In addition to previous regulations, it provided for a custodian of the borough dump and established hours when the dump would be open for disposal of refuse by licensed haulers and people who haul their own refuse. No regulation was provided for use of the dump until adoption of the 1956 ordinance.

The present open dump has been in use since 1912 on a 13½-acre tract of land belonging to the Pennsylvania Railroad Company located near the eastern borough line. Permission was granted in that year by the Railroad Company to use the land in order to fill a natural depression and to cover many large boulders. Six acres of this tract were later leased to the Borough of Mount Union by the Pennsylvania Railroad Company in 1938.

Almost the entire leased portion of the land had been filled and leveled by 1958, and 3½ acres of the front part of the tract was sold to the Mount Union Chamber of Commerce. A shoe factory building was constructed on it for a new industry that was moved into the community. The factory has been in operation for two years and is now employing 175 people.

Rodent control has been in effect at the dump since 1953 under contract with an exterminating company. The dump custodian also sets out Warfarin rat bait at frequent intervals. No effort has been made to control flies and mosquitoes.

The open dump provided by the Borough for refuse disposal became more of a problem each year. Rules and regulations of the Advisory Board of the Pennsylvania Department of Health provide for the sanitary disposal of all decaying matter in Pennsylvania. The provisions apply equally to individuals, partnerships, firms and corporations. It is, therefore, a public necessity for an incorporated municipal government to provide for sanitary collection and disposal of all decaying matter originating within its corporate boundaries. The Borough Council gave recognition to the need for a more sanitary method of refuse disposal in 1959 when it directed the Borough Secretary to make a complete study and report on the situation.

The study and subsequent report are the result of consultation with many equipment dealers, nearby Boroughs where collection and disposal of refuse is handled as a borough function, many published articles on the subject and the Pennsylvania State Association of Boroughs. Surveys were also made among local business and professional people and an actual count, over a period of two weeks, was made of the trucks and cars coming to the dump with refuse. The findings reported vary slightly from the national averages established by the joint study on Refuse Collection and Disposal by the American Public Works Association and the United States Department of Health, Education and Welfare published in 1951.

Compactor Truck Capacity

During the study period of two weeks, the average number of loads per day of uncompacted refuse dumped (from May 6, 1960 to May 19, 1960, Sundays excluded) was: 11 truck loads of 6 cu. yds. each; 19 pick-up truck loads of 2 cu. yds. each; and 43 passenger car loads estimated at 4 cu. ft. each.

Some of this came from the surrounding small communities of Allenport, Kistler and Cedar Crest with a combined population of 1100. The tabulation indicated an average of 110 cubic yards of uncompacted refuse being dumped per day. This would be reduced to 37 cubic yards by use of compactor type trucks according to information furnished by manufacturers.

A small compactor truck may be used because of the proximity to the disposal area if the land at the present Borough Dump is purchased for a sanitary landfill. A 16-cubic yard truck, working 5½ days a week, would be required to make 3 trips a day to the landfill area to dispose of the 259 cubic yards of compacted refuse produced weekly in the Borough. The use of a 20-cubic yard truck would, of course, require only 2½ trips a day to the disposal area.

Time Required for Collection

The number of carry-outs per 8-hour day with a three-man crew is 533 for curb or alley collection or 282 for carry-out collection from the property, according to national averages shown in the report of the APWA and the PHS. This is cor

siderably higher than the experience of some Boroughs in this area and these figures are, therefore, reduced to 400 for curb or alley collection and 200 for carry-out collections.

There are 980 residences in the Borough that need refuse disposal service. One pick-up per week from residential users will require five 8-hour days (40 hours a week) for complete carry-out service or 2½ days (20 hours a week) for curb or alley collection. It would, therefore, be possible to have 2 pick-ups per week for residential users by curb or alley pick-ups or 1 pick-up per week by furnishing complete carry out service.

A post card survey on return post cards mailed to 65 local merchants and professional people indicates that less than half of them use the existing refuse disposal service. Those who are using it, however, expressed satisfaction with the service. Of the cards, 53 were returned after completing the questions listed on them. The thirty commercial users of the service, according to our return post card survey, will need 3 pick-ups a week. This will require 90 pick-ups or 4 hours per week with complete carry out service.

It will, therefore, require 44 hours a week for a crew of three men and a compactor truck to furnish complete carry out service for residential and commercial users of the service. This can be reduced to 24 hours a week by one curb or alley pick-up from residential users a week and three carry-out pick-ups from commercial users.

Disposal Site, Supervision and Equipment

Because of its proximity to the center of the Borough, the 9.9-acre tract of land at the present open dump site is conveniently located. This tract of land has been offered to the Borough Council for a sanitary landfill by the Pennsylvania Railroad Company for $4000, with a provision in the deed that the Railroad Company may repurchase the tract when it is no longer used for a refuse disposal area. The present dump occupies 3.5 acres of this tract of land which leaves a remainder of 6.4 acres that may be used for a future landfill operation. It will require about one acre a year to dispose of the refuse originating in the Borough, provided the completed landfill is an average of 8 feet deep. This tract will, therefore, provide a disposal area for approximately 5 to 6 years. The tract is a swampy depression and the completion of the fill will make the land suitable for an industrial site or for some other useful purpose.

One full time attendant will be required at the disposal site. He can also operate the equipment used for landfill. This is the standard practice among smaller municipalities.

A small crawler type tractor with a front end loader will be needed for the landfill operation. This tractor will not operate at the landfill for the entire 8-hour period each day. If equipped with a backhoe it could be used on other work in the borough. The cost of a backhoe attachment would be approximately $2500, and a trailer to transport the tractor would cost an additional $1500.

The equipment listed in Table 1, in compliance with the provisions of the Borough Code and the best municipal purchasing practice, should be purchased by competitive bidding from the lowest responsible bidder. This purchasing procedure, of course, applies only if the equipment is purchased by the Borough.

The following cost of disposal of one cubic yard of compacted refuse at the proposed sanitary landfill site is based on 37 cubic yards of compacted refuse a day, a 30-day month and the estimated monthly disposal cost of $625. Thus $625 ÷ (37 × 30) = 56.3 cents per cubic yard for disposal. If the Borough operates the landfill at the disposal site, without also operating the refuse collection service, it will be necessary to assess a charge against the users of the landfill disposal facilities to cover the cost of operating it. Based on the foregoing unit cost of 56.3 cents per cubic yard of compacted refuse (about 20 cents for uncompacted refuse) it will be necessary to estab-

(*Continued on page* 148)

Table 1—Estimated Cost of Refuse Collection and Disposal Equipment, and Disposal Site

Collection Equipment		
Truck chassis	$5,800	
16-Cubic yard packer body (mounted on chassis)	5,000	$10,800
Disposal Equipment		
Diesel crawler tractor (37½ HP) with ⅞-cubic yard front end bucket with teeth		8,000
Total Estimated Cost of Equipment		$18,800
Land 10 Acres (Purchased from Penna. Railroad Company)		4,000
Total Capital Investment		$22,800

Table 2—Estimated Monthly Operating Costs

Collection		
1 Truck driver, 44 hrs. a week at $1.35 an hour	$270	
2 Helpers, 44 hrs. a week at $1.25 an hour	495	
Maintenance and operating cost of equipment	150	
Financing payments, equipment*	203	$1,118
Disposal		
1 Attendant and equipment operator, 44 hrs. a week at $1.50 an hour	295	
Maintenance and operating cost of equipment	104	
Financing payments, equipment and site*	226	625
Total Estimated Operating Cost		$1,743

*At 5 percent interest, 5-year amortization period.

Table 3—Estimated Revenue and Expense

Anticipated Revenue	
900 Residential users of service @ $1.90	$1,710
30 Business users of service @ 6.00	180
Total Anticipated Revenue Per Month	$1,890
Estimated Expense	
Refuse collection	$1,118
Refuse disposal	625
Contingencies and major repairs	147
Total Estimated Expense Per Month	$1,890

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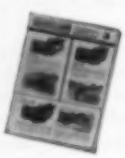

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AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

New York Congress and Equipment Show Sets All-Time Attendance Record

With a registration of nearly 4,000 and 140 exhibits, the 1960 Public Works Congress and Equipment Show stands as the largest and perhaps the most successful annual meeting in the history of the Association. From the welcoming address by Mayor Robert Wagner to the close of the banquet in the grand ballroom of the Hotel Astor, it was a very profitable and pleasant experience for the many members and their wives and guests.

Jean L. Vincenz, at the close of a very successful year, turned over the gavel to incoming President Frederick W. Crane, general manager, Buffalo Sewer Authority, Buffalo, N. Y., at the Wednesday evening dinner. Prior to his appointment as manager of the Sewer Authority, Crane served as Commissioner of Public Works of Buffalo, and before that as city engineer. A member of the APWA since 1946, he is a past president of the New York Chapter and has been a member of the Board of Directors since 1953.

Other newly elected officers were installed at the business meeting. Albert G. Wyler, director of streets, New Orleans, La., was elected vice president. Wyler has served on the board since 1952 and has held such positions as treasurer and vice-president of the Southern Region, and is a past president of the New Orleans Chapter. George Maher, director of public works, Lewiston, Me., will succeed Charles W. Cooke, director of the Greater Hartford (Conn.) Flood Control Commission, as Director of Region 1. Maher has been a member of the Association since 1950 and is a past president of the Maine Chapter. Robert S. Hopson, director of public works, Richmond, Va., and Harlan Hester, superintendent of streets, Fort Worth, Texas, were re-elected as Directors of Regions 3 and 7, respectively. Manon P. Phillips, commissioner of public works and city engineer, Augusta, Ga., was named Director of Region 4 to fill the vacancy created by the elevation of Wyler to vice president.

Other features of the business meeting included President Jean Vincenz's message. In his brief remarks Vincenz thanked the members of APWA, the Board of Directors, Commissioner Paul Screvane and the Local Committee for Congress arrangements, the Sustaining Members of APWA, the Association's staff, and Executive Director Robert D. Bugher for the cooperation, excellent work and many accomplishments of the past year. He said the goals for the APWA for the "sixties" are not really different from those of the "forties" and "fifties," but the opportunities that lie ahead are greater and the horizon wider, and that we must raise our sights.

Vincenz also read from a letter he received just prior to the Congress from the President of the United States, Dwight D. Eisenhower, in which the President said in part, "It is a pleasure to send greetings to the members of the American Public Works Association assembled in New York for their Sixty-sixth Annual Meeting. This meeting, bringing together administrators, planners, and engineers from the various levels of government, helps to strengthen the cooperation and coordination necessary throughout the field of public works."

Samuel Baxter, Commissioner, Water Department, Philadelphia, Pa., chairman of APWA's Research Foundation gave a report on a $40,000 grant recently received from the Ford Foundation for an exploratory study of research problems and priorities in the public works field. A resolution was adopted at the business meeting to express sincere thanks to the Ford Foundation for making it possible for the Association to undertake this study. The annual report to the membership was presented by APWA's executive director Robert D. Bugher.

A resolution was also passed requesting the Federal Highway Administrator to make available funds for research on methods of disposal of land-clearing debris resulting from demolition of buildings and clearing of land for highway rights-of-way. This is of particular importance in areas where open burning is prohibited because of local conditions and ordinances.

Curtis E. Woods, Director of Sanitation, Little Rock, Arkansas was honored as the 5,000th member of

OFFICERS: Frederick W. Crane, Buffalo, N. Y., *President;* Albert G. Wyler, New Orleans, La., *Vice President.* REGIONAL DIRECTORS: (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; Roy W. Morse, Seattle, Wash.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; Edward J. Booth, Bismarck, N. D.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas. *Immediate Past President,* Jean L. Vincenz, San Diego, California. Robert D. Bugher, *Executive Director.*

An Exhibit That Won't Be Shipped Back Home

● **BEFORE the APWA Congress and Equipment Show closed in New York City, this first unit of the new Heil Colectomatic Mark II to come off the production lines had been purchased. Joseph F. Heil, President of the Heil Company, presents the keys to Joseph L. Rosano, Deputy Sup't of Public Works, Middletown, Connecticut.**

the Association and presented with a special certificate.

Special recognition was given to Mayor Wagner, New York City; Paul Screvane, Commissioner of Sanitation, New York City, chairman of the local committee; exhibitors, program participants, and the many other persons who helped to make the Congress successful.

The membership proudly elected Robert Moses, President, 1964-65 New York World's Fair Corp., and long-time construction coordinator for New York City an honorary member of the Association. As chairman of the State Power Authority he played an important part in the development of the vast St. Lawrence Seaway Project and is directing construction of the Niagara Power redevelopment. He organized and coordinated the vast program of expressways and arterial highway construction with housing and related improvements. During the past thirty-five years Mr. Moses has served the State of New York under every governor since Smith and New York City under all mayors since LaGuardia.

Thirty-four members of the APWA received the Samuel A. Greeley Service award, an award presented each year to persons who have been members of the Association for at least five years and who have served the same municipality continuously for thirty or more years. Included on the list were Joseph C. Brousseau, director of public works, Verdun, Quebec, Canada; and Russell Shifley, superintendent, Streets and Sewers, Owensboro, Ky., who have served

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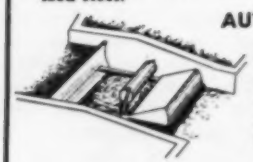

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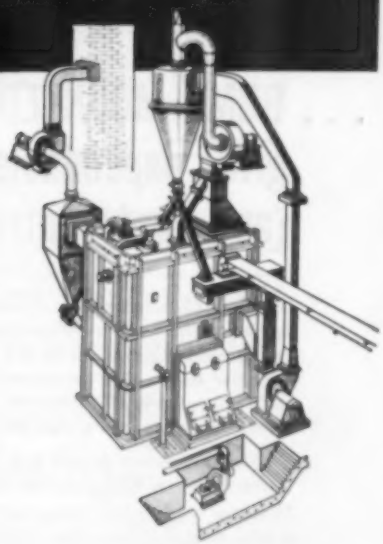

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their respective communities for over 39 years. A 30th Anniversary dinner was held in honor of Samuel A. Greeley who established the award, with over 100 in attendance. He was presented with a gold watch in recognition of his service to the public works field.

Another highlight of the Congress was the premiere of "Headline for Harper," a 30 minute, 16 mm sound documentary motion picture that spotlights 50 years of public works progress and illustrates the importance of this vital field of activity. The film was prepared as a public service by International Harvester Company.

In his welcoming address, Mayor Robert Wagner asserted that we must plan, administer, and govern so that the needs of our own people will be met. "And at the same time," he said, "We must act so that our accomplishments, our good works and our standards of service will be an inspiration to freedom-loving peoples everywhere." Mayor Wagner went on to say that the APWA can become a rallying point for the type of trained personnel, engineers, scientists and specialists who will push our research and public works accomplishments to new heights. "The important steps you are now taking in your educational program can only make further contributions to the welfare of our people," he remarked.

Robert Moses, long-time construction coordinator for New York City, was featured speaker at the banquet. At the close of his talk he emphasized, "All of you, whether public administrators, consultants, contractors, workers, makers of equipment or material merchants, in one way or another are more and more dependent on government for your livelihood, success and well-being. Our government at all levels must improve enormously if we hope to keep up with population, raise our output and income, maintain living standards, help others and meet foreign competition. If you really want to help government, forget for a while at least the forms, charts and dogmas of efficiency experts, reformers and civic uplifters as to what is national, state or municipal. Be pragmatic. The agency which can do a job best is the one to do it. But always our task is to find the men and women who can lead, to encourage them, to give them incentives, rewards, status and respect, and to protect them from gratuitous insult, marginal libel and dirty, irresponsible guttersnipe attacks. Public servants are not the enemies of private enterprise. They are not rivals. In the partnership of government and individual initiative lies the hope of democracy."

APWA Receives $40,000 Grant From the Ford Foundation

The Ford Foundation has approved a grant of $40,000 to the American Public Works Association for an exploratory study of research problems and priorities in the public works field. The announcement was made by Samuel Baxter, Commissioner of Philadelphia's Water Department, who is chairman of the APWA Research Foundation's Board of Trustees.

It was pointed out that in spite of the tremendous sums of money now being expended on public works and in spite of their importance to the citizens of our communities, there is an appalling lack of research being carried on to find better ways and means of providing the facilities and services desired by the people.

Baxter explained that for many years it has been recognized that one of the major obstacles to research in the field of public works is the lack of well documented re-

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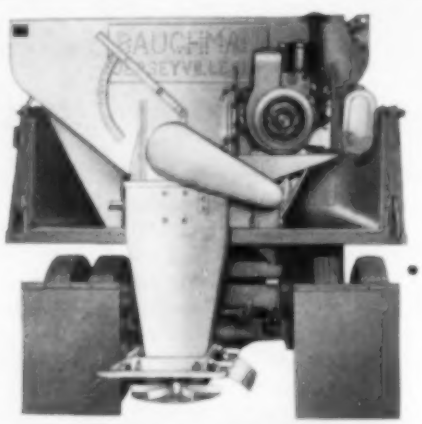

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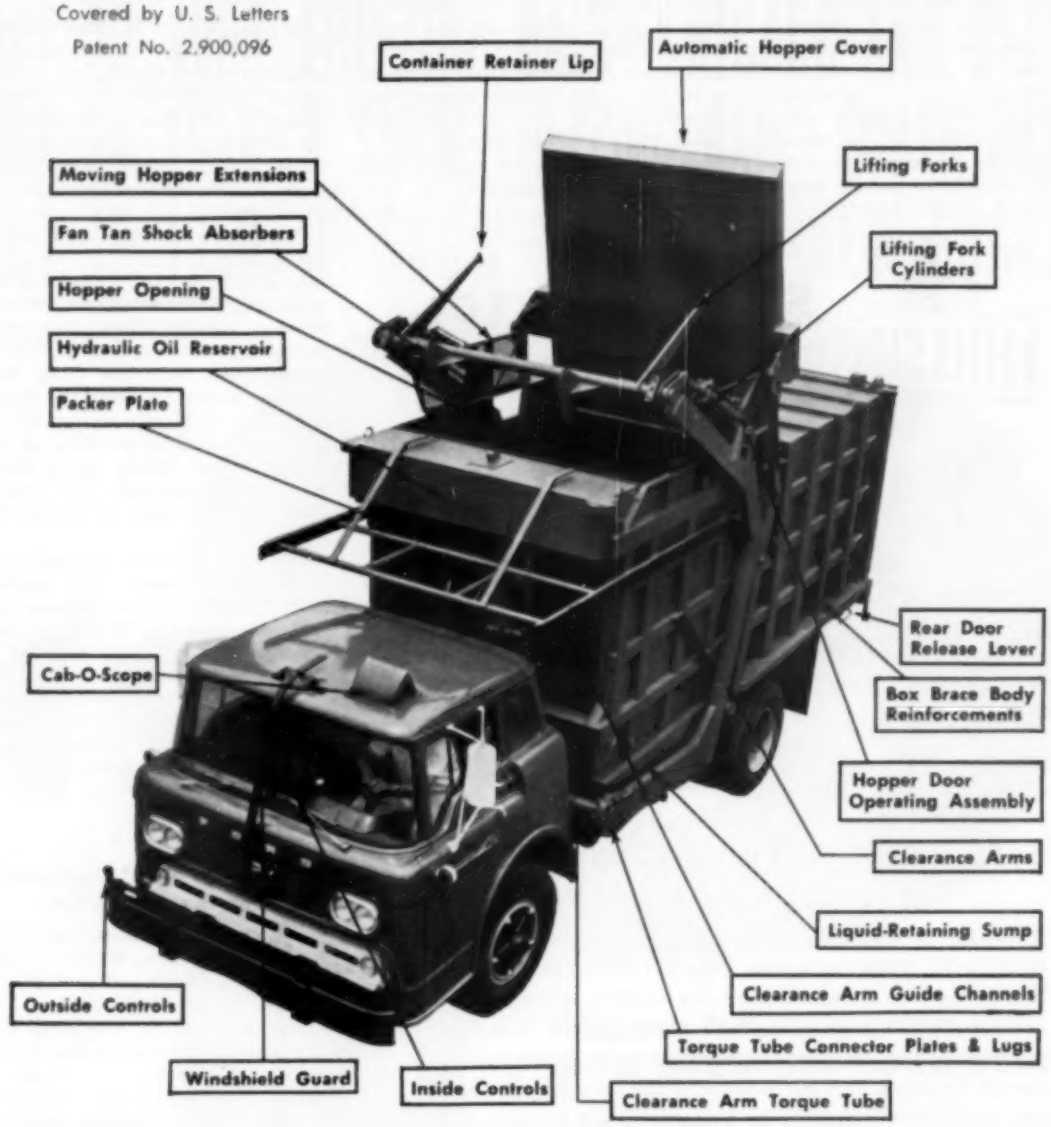

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search needs. Therefore, the Association's Research Foundation feels that the best way to accelerate research in this field is to make it possible for research and scientific minded persons to survey present day operations in the light of rapidly advancing technology so that new techniques can be developed and applied to public works problems.

This one-year study will be carried out by a project director and a select group of consultants representing various lines of allied interest. The APWA is a non-profit public service organization composed of over 5,000 public works officials. Its Research Foundation was established in 1955 to promote research in the broad field of public works engineering and administration.

The foundation provides a practical means for cities and other units of government to join together and share the cost of research on problems of common interest. The most recent project initiated by the Association's Research Foundation is a $17,500 study leading toward the development of a simple and reliable method of monitoring emissions from incinerator stacks. This study is being undertaken by the Armour Research Foundation of the Illinois Institute of Technology and is financed by New York, Philadelphia, Milwaukee, Hartford, Conn., Norfolk and Arlington County, Va.

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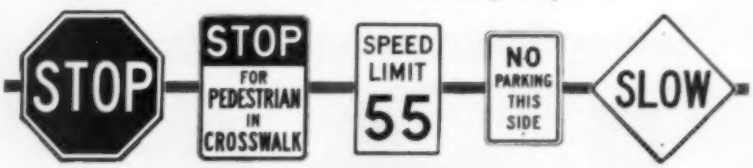

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Howard Clark Receives Education Award

Howard Clark, 37, East Orange, N. J., has been named the 1960 recipient of the $1,000 Aid-to-Education award, donated by *The American City* and administered by the APWA. The announcement was made at the Public Works Congress and Equipment Show in New York City.

Clark, who won the award against nation-wide competition, is a student at the Newark College of Engineering, Newark, N. J., attending evening classes. Clark received a bachelor of science degree in forest management from the Utah State College, and is now working toward a B.S. in civil engineering. He has been employed by the City of East Orange, New Jersey, as a Senior Engineering aide since 1954, and in 1957 was advanced to Junior Engineer.

The award is made annually to an undergraduate senior or graduate student who wishes to prepare himself for a career in the field of public works. Clark was selected by the award committee in recognition of his demonstrated technical abilities, on-the-job performance, scholastic capacity and personal qualities particularly desirable for a career in public service.

• • •

Wide Variety of Equipment Purchased by a City

Automotive equipment purchased in 1959 by Bangor, Maine, included one ¾-ton Dodge pickup truck; six Dodge Police Cruisers and one Dodge panel truck; one small English Ford, four-door sedan for the Police Department. Purchases for the Public Works Department included a Galion 3-wheel roller; one 20-cubic yard rubbish packer for an International Truck with Leach Packmaster body; one International 5-yard dump truck with plow and two International 3-ton dump trucks; one Willys jeep; a Tarco salt spreader; a Baker Flink reversible snow plow; and a Hi-Way hopper type spreader, mounted on the city truck. The spreader was added to the fleet in December, 1959, and did a remarkable job of sand spreading for the Public Works Department.

OCT. 20, 1952: 4" SNOW—WILKES-BARRE-SCRANTON, PENN.
OCT. 10, 1954: 6" SNOW AND SLEET—CLEVELAND, OHIO
OCT. 25, 1955: FREEZING RAIN—CHICAGO AND DETROIT
OCT. 24, 1956: 3" SNOW, FREEZING RAIN—SOUTH DAKOTA
OCT. 18, 1959: 3" SNOW—NORTHERN NEW ENGLAND

(Source: U. S. Weather Bureau Climatological Data)

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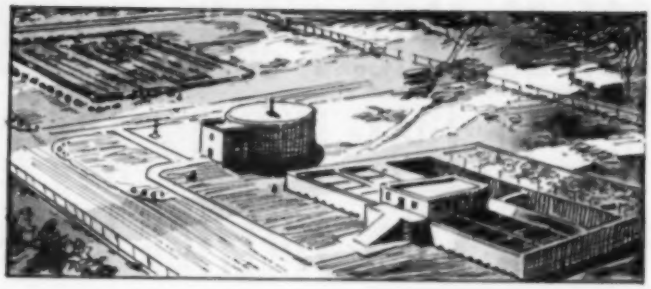
THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Sewage Effluent Use Project

Several years ago the coastal farmers of Talbert County in Southern California unanimously passed a bond issue of $275,000 and formed the Talbert Water District leading to the use of the effluent from the Orange County Sanitary Districts' primary sewage treatment plant as a source of water for irrigation. A formal agreement covering the use of the effluent was made and had the following requirements: The effluent storage reservoir will be drained and cleaned regularly; a skiploader will be used to remove accumulated sludge; and a well or water tank will be provided to supply fresh water flushing; a portable trash pump will be used to pump the flush-water back into the outfall; dead ends of each branch lateral will be drained into the Talbert Drainage District's lines. No effluent will be used within 100 ft. of any home service or private domestic water lines; abandoned wells will be completely clay filled. Only crops approved by the health department will be irrigated, i.e., alfalfa, sugar beets, dried beans and dried peppers. Corrosion of lines by sulfides is of great concern and odors are a problem. About 2800 acres of farm lands are being irrigated under this system and the valley farmers seem to be satisfied that this is a worthwhile project.

"Organizing a Sewage Effluent Utilization Project." By Paul W. Travis. PUBLIC WORKS, September, 1960.

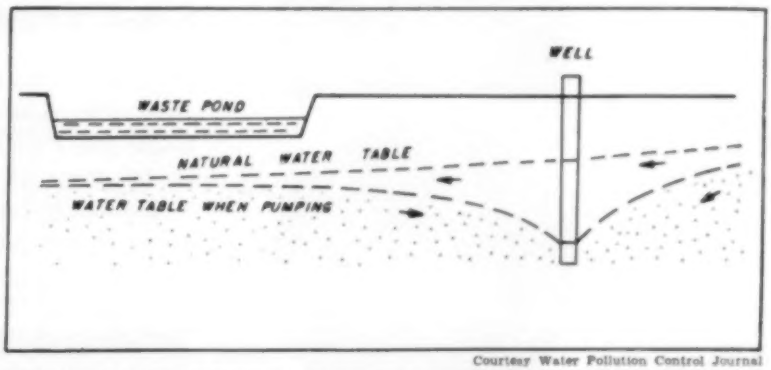
Stabilization Ponds

Stabilization ponds have been in use in the Great Plains states for a number of years as an inexpensive and generally successful method for treating the raw sewage of small municipalities. Basically similar "oxidation" ponds have been used in the southwestern states for several decades for the secondary and tertiary treatment of sewage. They have also been used in a similar manner for the treatment of industrial wastes but with various modifications in the stabilization and disposal processes. In the article the author discusses the various factors having an influence on the effectiveness of the stabilization ponds as well as how the results are influenced. With respect to the potential effect on ground water quality, the critical factor in the operation of the ponds is the degree of infiltration of sewage liquids through the bottom of the pond. The effects of distance of the ponds above the zone of saturation, the influence of permeability of the geologic formation and the velocity of ground water movement on bacterial and chemical travel are discussed in some detail. With reasonably accurate determinations of the quantity of water in the ground, its sources of replenishment, directions of flow, rates of flow and localities of its discharge, etc., stabilization ponds may be located and designed with considerably more scientific and engineering skill.

"Geologic and Hydrologic Aspects of Stabilization Ponds." By Gerald Meyer, District Geologist, U. S. Geological Survey, Morgantown, W. Va. *Journal Water Pollution Control Federation*, August, 1960.

Halogens In Sewage

Chlorination is recognized as the cheapest method for disinfection of water and liquid wastes. Other halogens cannot be expected to compete economically with chlorine, especially in sewage treatment. An investigation was undertaken with the hope that it would lead to a better understanding of the mechanisms by which halogens kill or inactivate pathogenic organisms. From this study the authors have concluded that molecule for molecule, residual concentrations of iodine, bromine, and chlorine, as determined by the acid-KI backtitration method, are about equally effective in colicidal action. On a dosage basis, however, and especially for small applications, chlorine is superior because much of the iodine



Courtesy Water Pollution Control Journal

● **WATER infiltrating into aquifier from waste pond may be drawn to areas of pumping, reversing normal direction of flow; and the area of influence may be quite large.**

Twelve P.F.T. Floating Covers with P.F.T.—Pearth Gas Recirculation on 110' Digesters at Cincinnati's new Mill Creek Sewage Treatment Plant.

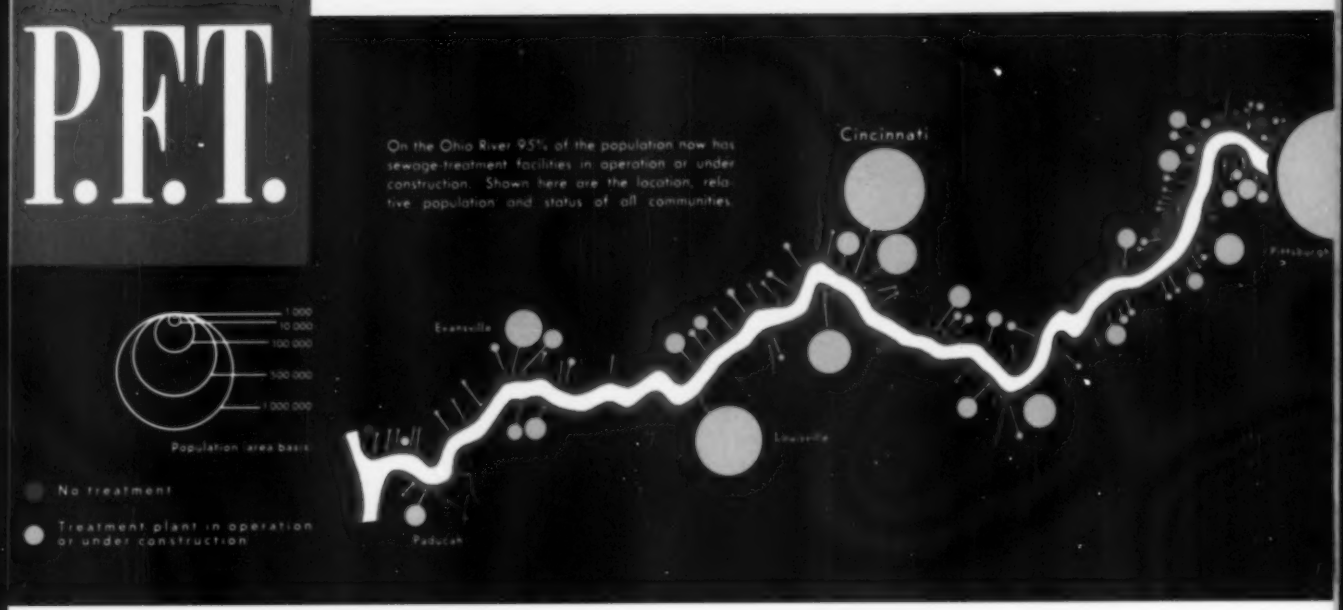
Cincinnati Continues Leadership in Ohio River Clean-Up Program

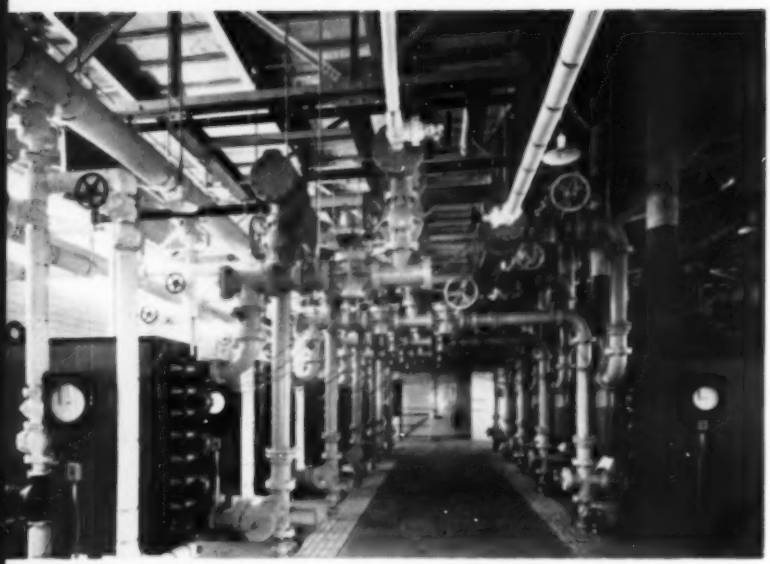
Exalted in song and legend for its beauty, the Ohio River is being restored through the pledged efforts of eight states to keep the river free of pollution.

Leading this crusade under the program of the Ohio River Valley Sanitation Commission (ORSANCO) the city of Cincinnati has constructed three plants: Little Miami, Muddy Creek and Mill Creek. Largest of the plants is the modern Mill Creek plant. This facility with a design flow of 120 mgd is the heart of greater Cincinnati's program which handles not only all wastes from Cincinnati but 26 suburbs and some 2,000 industries.

P.F.T. Digester equipment matches the other facilities at this plant which are blended to make this America's most functionally beautiful and modern plant. Many "firsts" including newly developed laboratory analytical equipment for rapid checks of industrial wastes and closed circuit television giving visual checks of operation of various plant units ensure the most effective treatment. With this plant now in service, Cincinnati is truly leading the way to a renewed beautiful Ohio.

P.F.T.


On the Ohio River 95% of the population now has sewage-treatment facilities in operation or under construction. Shown here are the location, relative population and status of all communities.
Cincinnati
Evansville
Louisville
Paducah
1 000
10 000
100 000
500 000
1 000 000
Population area basis
No treatment
Treatment plant in operation or under construction



Battery of P.F.T. Heat Exchangers and Heater Units.

Entire project including innovations in plant control under the direction of Arthur D. Caster, Sewage Disposal Engineer

Cincinnati's entire sewage treatment program was designed by the consulting engineering firm of Havens and Emerson

Depicted on the above map are the locations of sewage treatment plants safeguarding the Ohio River. P.F.T. is proud to have a major part in this vital program with equipment at a large number of these plants.

Cincinnati's Mill Creek plant, ORSANCO'S leader, embodies "leadership equipment" designed and manufactured by P.F.T.

Here at this modern plant are twelve P.F.T. Floating Covers on 110' digesters with P.F.T. aluminum metal clad insulated roofing. Six of these controlled digesters are equipped with P.F.T.—Pearth Gas Recirculation units with the balance arranged for future Pearth installation.

Shown in the photo at the left is Cincinnati's "Hall of Heaters" with four P.F.T. 1300S Shell and Tube Heat Exchangers, two P.F.T. 1000 and five P.F.T. 1500 Heaters and Heat Exchangers. Also located adjacent to the digesters are twelve additional P.F.T. 500 Shell and Tube Heat Exchangers.

These 23 P.F.T. Heat Exchanger units are integrated to form an effective, flexible heating system ensuring accurate temperature control for the 12 digesters. P.F.T. Gas Safety Equipment ensures safe utilization of sewage gas produced.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO. 4241 RAVENSWOOD AVENUE, CHICAGO 13, ILLINOIS

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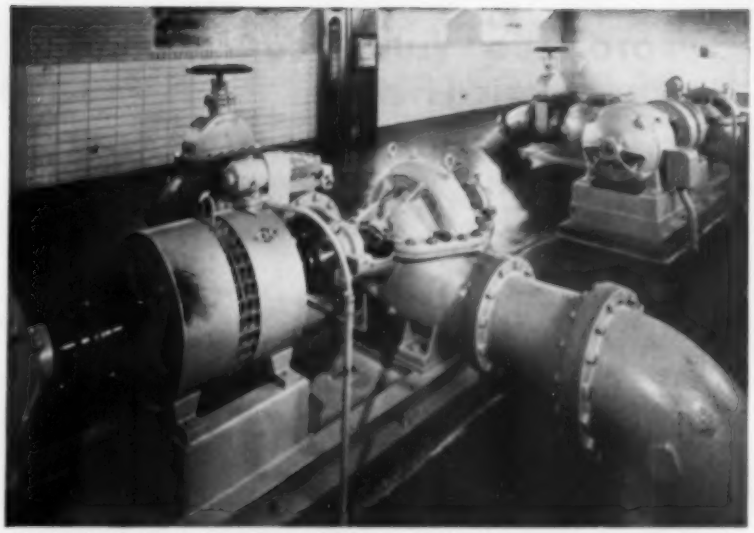
or bromine is utilized in satisfying the halogen demand. On a weight basis, chlorine is by far superior to bromine or iodine owing to the high molecular weights of the heavier halogens. Thus, 8 mg/L of chlorine will achieve disinfection comparable to that of 45 mg/L of bromine or iodine. Chlorine, moreover, is much less costly than other halogens. These weight and cost factors combine to exclude bromine or iodine from any practical consideration in the disinfection of sewage. The first part of this excellent article relates to the chemical considerations in the actions of halogens on the disinfection of settled sewage while the second part covers the colicidal effects of halogens in sewage.

"Chemical and Colicidal Effects of Halogens in Sewage." By Jack E. McKee, Charles J. Brokaw, and Ronald T. McLaughlin, Division of Engineering, California Institute of Technology, Pasadena, Calif. *Journal Water Pollution Control Federation*, August, 1960.

Making Topsoil With Wet Sludge

The San Diego, Calif., sewage treatment plant has discontinued the dewatering and drying of sludge and its bagging for fertilizer. Instead, it has devised a method of disposing of its wet digested sludge and creating a synthetic topsoil on over 2,000 acres of park lands in the Missouri Bay Recreational Area. As a result of this program since 1958 no sludge has been disposed of through the outfall into San Diego Bay. Instead the sludge has been applied to the land primarily created by dredging. A special plow was purchased to prepare the land in long deep furrows. Sludge is transported in a special tank truck and tank trailer equipped with 4-inch outlets and valves. As soon as the furrows in an area have been filled with sludge, a tractor with a special blade covers and fills the furrows by dragging. After one or two weeks the area is cross-furrowed to receive sludge again in a similar manner. The sludge is hauled by contract on a bid cost per gallon basis. This cost has decreased steadily since the inception of the program from $0.0039 per gallon in 1956-57 to $0.0019 per gallon in 1959-60. This amounts to an average disposal cost per ton of dry solids of $16.82 in 1956-57, but only $7.91 per ton in 1959-60. The average solids concentration is about 6 percent, with variations between 4.5 and 9.0 percent. Improved con-



E-M Ampli-Speed Drives provide Odessa, Texas Municipal Sewage Plant with adjustable pumping rate of 1 to 5.4 MGD. Pumps are held to ±2% of manually selected speeds.

Make two pumps do the work of three!

Here's how Odessa, Texas did just that with adjustable speed E-M Ampli-Speed Drives

PROBLEM: Odessa, Texas wanted to increase sewage facilities to treat sewage effluent as a source of industrial water for chemical and rubber plants.

OBJECTIVE: They needed a new, efficient sewage pumping station at minimum cost, with provision for future capacity.

SOLUTION: Odessa officials called in Parkhill, Smith & Cooper, consulting engineers of Lubbock, Texas. P. S. & C. suggested two alternatives: 1. Build a plant with three pumps, including one for peaking and standby; or 2. Install two pumps with E-M Ampli-Speed Drives.

Parkhill, Smith & Cooper favored the 2-pump plan for these reasons:

Minimum Capital Investment. The three-pump plan would tie up a considerable amount of capital in an extra pump, motor and control without adding appreciably to the volume of sewage pumped.

100% Peak Standby Capacity. Two pumps with E-M Ampli-Speeds could handle present demand efficiently, yet still have enough reserve capacity for 100% peak standby.

Low Cost Expansion. Later another pump could be added to *double* the station capacity and still allow 100% peak standby. And as a further saving, the building would *not* have to be enlarged to accommodate this third pump.

RESULT: Odessa took the advice of its consulting engineers and is now enjoying efficient, low cost pumping.

As your pumping requirements grow, you too will want the economy and versatility that E-M Ampli-Speed Drives give you. Write the factory today for descriptive Ampli-Speed Bulletin No. 243, and call your nearby E-M Sales Engineer for details.

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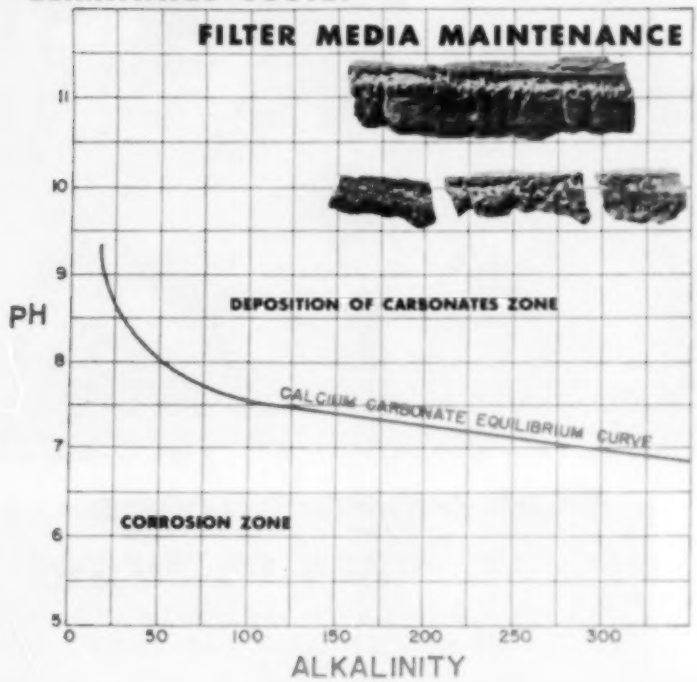
ELECTRIC MACHINERY MFG. COMPANY

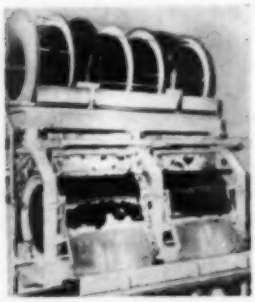
MINNEAPOLIS 13, MINNESOTA

Specialists in making drives do **EXACTLY WHAT YOU WANT THEM TO**

"ROTO-PLUG" SLUDGE CONCENTRATOR ELIMINATES COSTLY



The "Roto-Plug" Sludge Concentrator dewaters sewage sludge without the use of conditioning chemicals. This feature eliminates the costly problem of periodic acid washing of filter media to remove calcium carbonate deposits. Where chemicals are used to condition sludge it adjusts the pH of the sludge upward to pH 9 or higher and causes the formation of calcium carbonate. When referred to the carbonate equilibrium curve of water practice, the condition of the sludge is found to be high in the "deposition of carbonate zone".



The "Roto-Plug" works with the sludge "as is" thereby eliminating the age-old problem of decreased production due to calcium carbonate blinding of filter media.

For full details about the economical "Roto-Plug" method of dewatering sewage sludge write for our four-page illustrated folder RP-100.

NICHOLS ENGINEERING & RESEARCH CORP.

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ditions in San Diego Bay have been noted and the city has benefited by a reduction in chlorine required to disinfect the sewage to meet the state's requirements. Public acceptance of the program at Mission Bay Park has been excellent and a lush growth of vegetation has taken place where it was feared that problems would occur in developing landscaping.

"Making Topsoil With Wet Sludge." By Isadore Nusbaum, Sewerage Superintendent and Leland Cook, Jr., Ass't. Sewerage Superintendent, City of San Diego, Calif. *Wastes Engineering*, August, 1960.

TV Inspection of Sewers

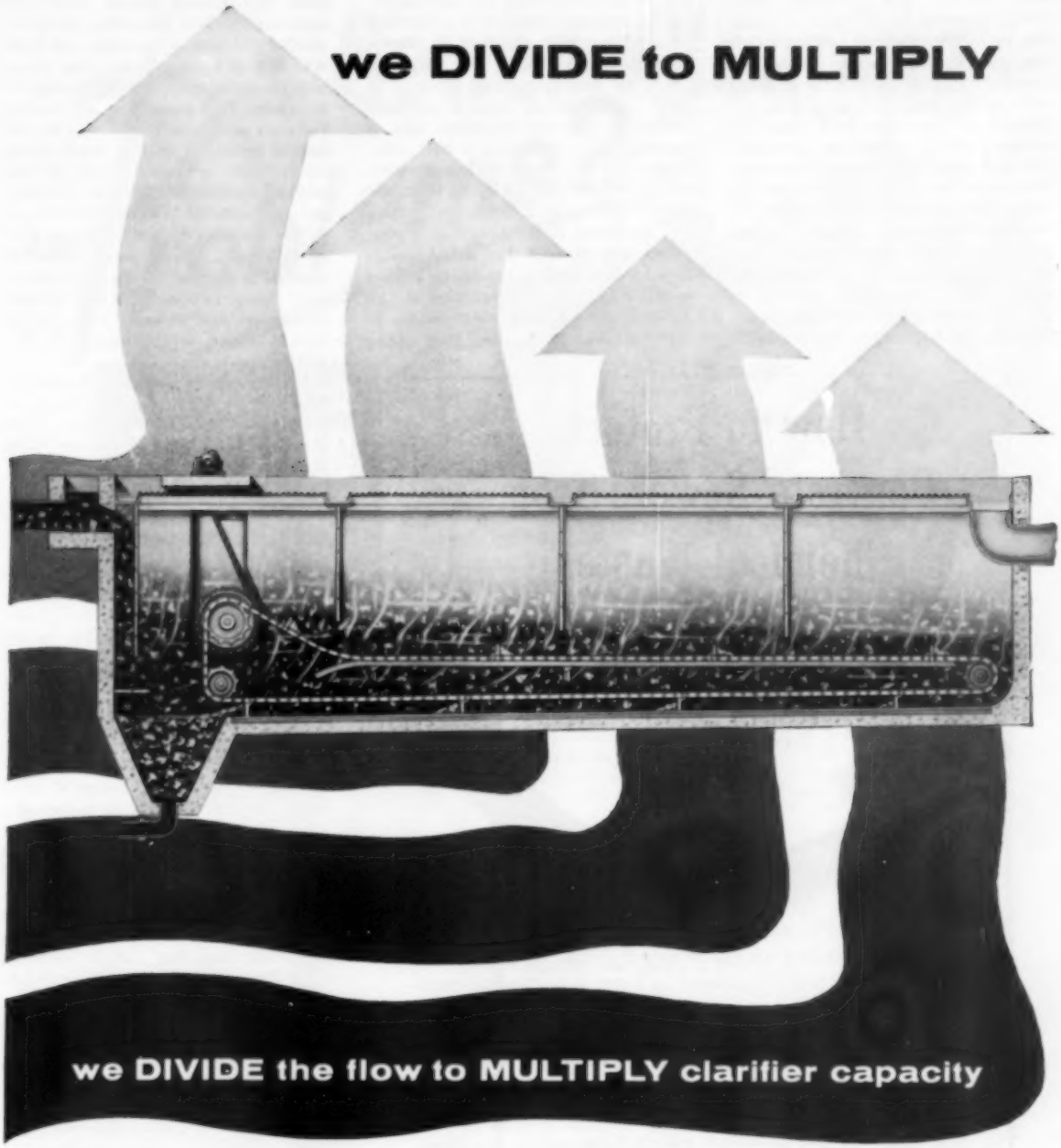
The use of closed circuit television for the inspection of storm or sanitary sewer lines, has become feasible due to the reduction in size of equipment and decrease in power requirements. With these reductions it became practical to house the camera in a waterproof cylinder small enough to use in eight-inch lines. By controlling the light intensity and location of the camera, clear, well-defined pictures of the interior of every pipe section are obtainable. By attaching a flexible cable to the front and rear of the camera it may be moved back and forth in the line as desired. Another recent development has been the use of a sequence camera in a watertight container which takes pictures at regular intervals. This procedure, however, does not permit the flexibility of closed circuit television. Use of closed circuit television for inspection and repair of sewer lines will probably increase as more engineers have the opportunity to observe the equipment under field conditions. It would have the effect of settling responsibility for infiltration and causes of infiltration in the construction of sewer lines.

"A Better Way to Survey Utility Lines." By James A. Hammack, Jr., Chief Sanitary Section, Corps of Engineers, Jacksonville, Fla. PUBLIC WORKS, September, 1960.

Refuse-Sewage Treatment Works

New Albany, Indiana, has recently located its new sewage treatment plant and mixed refuse incinerator on the same site and have combined plant functions where feasible. The sewage treatment plant is of the primary type with sludge treatment, consisting of vacuum filtration and

we DIVIDE to MULTIPLY



we DIVIDE the flow to MULTIPLY clarifier capacity

Rex Verti-Flo not only increases the clarifying capacity of tanks up to four times; it provides a far clearer effluent. The savings in equipment and construction costs are obvious. Here's how Verti-Flo does it: The unique design of Rex Verti-Flo Clarifier transforms the conventional horizontal-flow tank into a vertical-flow tank...utilizing the *full volume* of the tank and *minimizing short-circuiting*. This is accomplished by a system of collecting troughs, weirs and partitioning baffles which divide the large, horizontal settling zone into a series of small, vertical-flow cells. To assure maximum flow length and control, the weirs are adjustable entirely around the periphery of each cell.

Installed in existing tanks, Verti-Flo can be at least double the capacity of the tank...in new installations, Verti-Flo provides up to four times more capacity so that smaller basins can be used with considerable savings in both equipment and construction costs.

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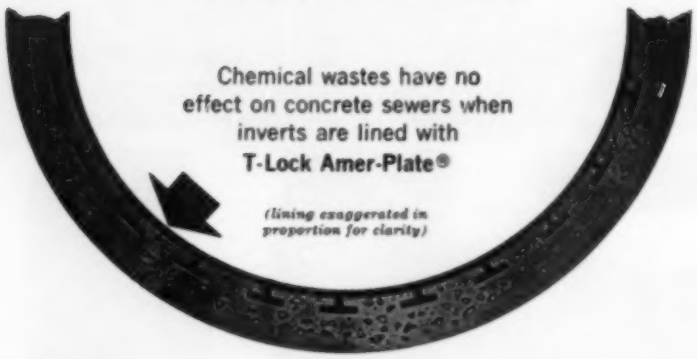
flash drying, and ultimate dry-sludge disposal by truck to a dump site, or by incineration. At the plant site, raw sewage passes through a barminutor, a measuring flume fitted with indicating, recording and totalizing instruments and into the primary tanks containing straight-line and cross-collector mechanisms. The outlet end of each tank contains eight 18-foot-long longitudinal V-notched collection troughs having 100 V-notch weirs per trough. Plant discharge is to the Ohio River. For odor control purposes, chlorine is added just ahead of the barminutor. Raw sludge is pumped to two holding tanks permitting its application to the vacuum filters at a controlled rate. After the addition of ferric chloride and lime, the mixture flows by gravity to the filters. The filter cake which results contains about 70 percent moisture and is carried by a continuous belt conveyor to a flash-drying system which utilizes the hot gases from the mixed refuse incinerator to reduce the moisture content of the sludge to about 8 percent. The dried sludge is then conveyed to trucks by means of a loading chute or carried to the two 80-ton per day incinerators to be disposed of by burning along with the mixed refuse from the community. The incoming refuse is discharged into a receiving pit from which it is transferred to the furnace charging hoppers by means of a crane. The gases are discharged through a single stack of 150-foot height provided with a stack spray to control fly ash. Design of the sewage treatment facilities is based on an expected 1980 population of 51,090 persons and an average flow of 6.13 mgd. Bonds were issued to finance the program for the design and construction of the sewage treatment and mixed refuse facilities at a cost of approximately $1,700,000.

"A Refuse-Sewage Treatment Works." By Marion Edlin, Superintendent of Sewage Treatment, New Albany, Ind. *The American City*, August, 1960.

How to Protect Concrete Sewers from Chemical Wastes


Chemical wastes have no effect on concrete sewers when inverts are lined with
T-Lock Amer-Plate®
(lining exaggerated in proportion for clarity)

T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H_2S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

The fact that T-Lock ends erosion and corrosion problems in industrial and municipal sewer systems is attested to by more than five million square feet now in use. Write for complete data on this maintenance-saving lining before designing your next sewer.

Applicators strategically located throughout U. S. and Canada

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ORP Measurement in Waste Treatment

The oxidation reduction potential (ORP) is one of the more poorly understood but yet potentially useful determinations available to the waste treatment field. The usefulness of the measurement can only be evaluated by an understanding of its principles and limitations. This is the purpose of this article. Generally speaking, all chemical reactions involving an exchange of electrons are considered to be oxidation-reduction reactions. The relative strengths of the oxidant and reductant involved can be measured by determining the oxidation-reduction potential. This can be done by inserting a platinum or rhodium electrode into the sample solution together with a constant voltage reference electrode and measuring the resulting emf by means of a high impedance potentiometer or similar device. The emf or voltage measured is the difference between the individual potentials developed at each electrode. Much of the confusion regarding ORP concerns the sign convention that exists, namely, the American Convention and the European Convention. The author discusses in detail the limitations of the measurement which must be recognized and each application and/or installation must be investigated with this in mind. A means of attaining reliability assurance must be established. Checking the electrode pair against quinhydrone solutions is one measure that can be employed. The ORP measurement is influenced by all oxidants and reductants and therefore cannot be considered a specific measurement.

Sewer Cleaning Problems?

Solve them all with POWERIZED O'Brien EQUIPMENT

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Sewerking Cable Machines

Bucket Machine and Dumper

O'Brien Power Rod Drive

O'Brien makes a complete line of sewer cleaning equipment. Every unit is the exact answer to a specific cleaning requirement and reflects O'Brien's long experience and familiarity with the field. Economy, efficiency, and convenience of operation are built into every piece of equipment.

O'Brien Power Rodder:

matchless driving and pull-back power, unexcelled for bucket threading and general sewer maintenance. 1200 ft. capacity can be used with either 5/16 or 3/8-inch rod. Equipped with automatic safety throw-out, positive rod drive, and footage meter.

Bucket Machine and Dumper:

featuring exclusive O'Brien hopper. Bucket dumps into hopper; after repeated bucket travel, full hopper is dumped into truck. Use of hopper eliminates truck and traffic tie-up during cleaning operation which relieves truck for many hours of other duties while hopper is being re-filled. 9 hp., 16 hp., and 25 hp. models available.

Sewerking Cable Machines:

compact, powerful, economical cable rodder. Ideal for removing roots, grease, sludge and general sewer waste. Four Sewerking cable models available with capacities from 250 to 600-feet.

Rodding Equipment and Accessories:

O'Brien manufactures a complete line of powerized cleaning equipment accessories and universal replacement parts for all makes of sewer cleaning units.

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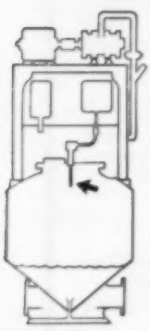

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YEOTRONIC control replaces the dual-electrode system and its long, troublesome electrode with a single short sensor that requires no attention.

YEOTRONIC is a major breakthrough in the electrical control of pneumatic ejectors. It is not a time-delay relay device...not a time-clock mechanism . . . but a modern transistor-operated unit designed to handle today's wastes without fouling.

YEOTRONIC is available at no extra charge on Shone®, Expelsor®, and Packex® electrically controlled pneumatic ejectors. For complete details, call your Yeomans representative or write for information.

E-6033

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As a result high measurement accuracy cannot be expected and the ORP is not a quantitative measurement but conveys only oxidation-reduction ratios. The most interesting applications in sewage treatment involve the following: 1) Treatment plant odor control; 2) aeration control sludge processes; 3) digester monitoring; and 4) influent monitoring to detect unwanted industrial waste reductants or oxidants. The two most significant processes in industrial waste treatment that practically demand employment of ORP are the cyanide oxidation and the hexavalent chromate reduction processes.

"ORP Measurement in Waste Treatment." By T. J. Kehoe and R. H. Jones, Applications Engineering Dept., Beckman Instruments, Inc. *Water & Sewage Works*, August, 1960.

Other Articles

"Maintaining **Sewage Flow Regulators:** Who should do it? How? How Often? Regular inspections and repairs will prevent excess wastage of flows and make "regulation" more than just a pious wish. By Max B. Phillips, Superintendent, Sewage and Industrial Wastes Treatment Plant, City of Bryan, Ohio. Wastes Engineering, August, 1960.

"The Same Service At Less Cost." Lakeland, Fla., adds a new type of vehicle, reduces its large-**container collection** fleet and provides the same service at less cost. By Earl E. Cole, Asst. Superintendent of Public Works. The American City, August, 1960.

"This, Too, Is **Sanitation.**" New York City's Department of Sanitation operates its own "navy" and police force, sells used autos and has a real estate operation in addition to the routine task of collecting and disposing of refuse and keeping streets clean. By Paul R. Screvane, Commissioner of Sanitation, New York City. The American City, August, 1960.

"Gas Analysis by **Chromatography.**" The short 5-minute period required for complete gas analysis with this equipment could make it a valuable tool. By W. L. Henderson, Research Analyst, Orange County, Santa Ana, Calif. Water & Sewage Works, August, 1960.

"Navy Housing Project Prompts **Sewage Treatment** Plant Project" for the City of Beeville, Texas. By L. E. Weber, City Manager, Beeville, Texas. Public Works, September, 1960.

"Engineering Aspects of Financing Sewage Authority Projects." The engineer has a definite responsibility in authority type of **financing to provide water and sewage facilities** in communities which cannot or will not finance such projects. By Samuel I. Zach, Vice President and Director of Sanitary Division, Gannett Fleming Corddry and Carpenter, Inc., Harrisburg, Pa. Journal Water Pollution Control Federation, August, 1970.

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for improved performance in trickling filters

DESIGNED FOR:

Maximum efficiency

- Aeration area increased
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Faster, easier installation

- Reduced laying time with only 7 units required to the square yard
- Increased bearing area for channel and perimeter cover blocks
- Simplified layout with 12" center-to-center spacing

High compressive strength—Low absorption rate

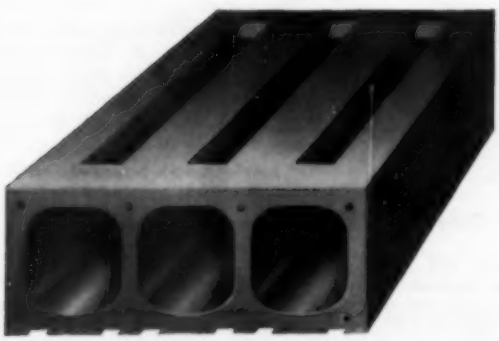
- Tested to loads up to several times that required by ASTM C 159
- Less than 6% water absorption by standard 1-hour boil method

Complete assortment of supplementary shapes

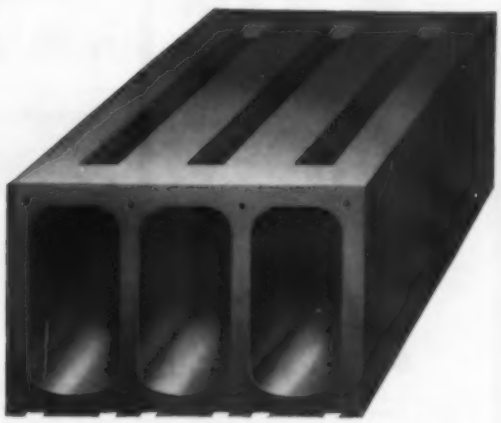
- Fractional, filler blocks, reducers, extensions, miters and cover blocks
- Layout and takeoff service
- Quick delivery

The new Natco vitrified clay TRI-FILTER block combines maximum capacity, both in drainage and aeration, with high strength, ruggedness, permanence and corrosion resistance, and all at minimum cost.

	Tri-Filter #5 Standard-Rate	Tri-Filter #8 Hi-Rate
Size	4¾" x 11¾" x 15½"	7½" x 11¾" x 15½"
Weight per unit	28 lb.	41 lb.
Weight per sq. yd.	196 lb.	288 lb.
Aeration per sq. ft.	39.3 sq. inch	393 sq. inch
Aeration %	27.3%	27.3%
Runoff sq. inch/lin. ft.	30.9 sq. inch	52.4 sq. inch
Runoff %	55.4%	59.3%



Tri-Filter #5
Standard-Rate



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reason: recessed impeller; continuous open passage (what will go in will come out)

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New, transistorized M-SCOPE PIPE FINDER only $189.50

Rugged, transistorized construction practically eliminates maintenance costs . . . extends battery life to a year or more. Pinpoint accuracy, greatest depth penetration make the M-scope first choice in the field!

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PUBLIC WORKS Magazine

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Refuse Collection Study

(*Continued from page 129*)

lish the following charges which would apply to all refuse haulers and to people hauling their own refuse to the disposal area: Dump trucks per load (6 cu. yds. per truck, uncompacted), $1.20; pick-up trucks per load (2 cu. yds. per truck uncompacted), 40¢; passenger cars per load (4 cu. yds. per car uncompacted), 10¢.

Rates for Complete Service

There are 980 potential residential users of refuse collection and disposal service in the Borough. During the two weeks when our tabulation of loads of refuse was being made at the Borough Dump, 5½ percent of the refuse was brought to the dump in passenger cars. Therefore, in order to prevent overestimating the number of residential users of the service and thus setting the rates too low, this number is being reduced to 900. Table 3 shows that it will be necessary to establish a rate of $1.90 a month for a single family dwelling and an average rate of $6.00 a month for service to the business establishments.

The rate of $1.90 a month for a single family dwelling covers the cost of operation only. It makes no provision for profit and it would, therefore, apply only if the refuse collection and disposal service is operated by the Borough. Of the $1.90 rate 64 percent or $1.22 covers the cost of collection and 36 percent or 68 cents covers the cost of disposal at a sanitary landfill.

The present private haulers charge a rate of $1.50 a month for a single family dwelling. If they would be required to assume the additional cost of sanitary landfill disposal, their rate would need to be increased 68 cents a month to cover the sanitary landfill costs. Their increased monthly rate would be $2.18.

Rules and Regulations

Rules and regulations governing the collection and disposal of refuse should be completely covered in an ordinance adopted for that purpose. The following provisions should be included in the ordinance to provide minimum control:

1) Definition of the terms used in the ordinance.

2) Provide for funds for the purchase of the land and equipment, and for operation of the service if done as a municipal service.

3) Provide for contract specifications if done by contract.

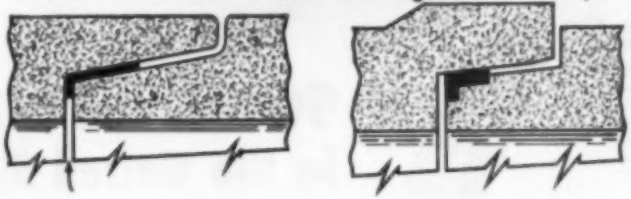
There's a quick-coupling, leak-proof, acid-resistant

TYLOX® *flexible* GASKET

for any type of concrete pipe sewer line you plan or build

Are your files up to date on the *full line* of Hamilton Kent TYLOX Gaskets? Whether you are planning lines using T & G, B & S, Offset or Recessed Pipe, there's a special TYLOX true compression Gasket, in either rubber or neoprene, to assure fast pipe-laying and make the joints water-tight and acid-resistant for the life of the pipe itself. Check this list, and write for the TYLOX Data Brochures needed to make your reference files complete:

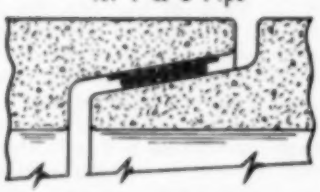
TYPE "C" and "C-P" TYLOX for Straight and Offset Pipe



Type "C" Tylox under full compression. Note the visual inspection feature.

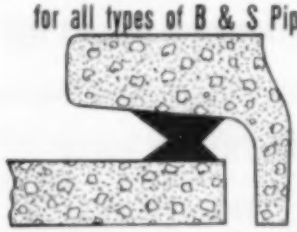
Type "C-P" Tylox under full compression. Flanges "lock" Gasket in proper position on the pipe offset.

TYPE "A" TYLOX for T & G Pipe



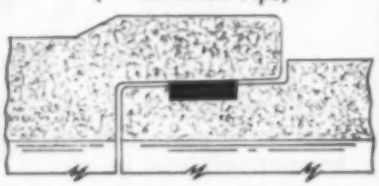
Type "A" Tylox under full compression on standard T & G Concrete Pipe.

TYPE "K" REXON for all types of B & S Pipe



Rexon "K" under full compression. Types available for both heavy and light duty service.

TYPE "CR" TYLOX (for Recessed Pipe)



Tylox Type "CR" under full compression. Wide, flat design makes "CR" roll and twist-proof.

USE THIS COUPON TO WRITE FOR MORE INFORMATION ▼

5132-3

HAMILTON KENT MANUFACTURING COMPANY
KENT, OHIO
427 West Grant St. ORchard 3-9555

Please send data brochures on the following Tylox Gaskets:
Type "A" ☐ Type "C and C-P" ☐ Type "K" Rexon ☐ Type "CR" ☐

Name_____
Firm_____
Position_____
Address_____
City_____ Zone____ State_____

NORTHWEST: Seattle 1, Wash., MUtual 2-7667 • CANADA: Cooksville, Ont., ATwater 9-3671

4) Set up schedule of charges to be made to the users of the service.

5) Establish the billing period and provide the terms of payment.

6) Make provision for permits for private haulers and the schedule of charges for dumping of refuse at the disposal area. Specify the type of truck to be used.

7) Provide for the proper storage of refuse and specify the size of containers to be provided by users of the service. (25-gallon maximum, 10-gallon minimum.)

8) Specify the frequency of collection and where refuse will be picked up.

9) Specify the place and method of disposal and the days and hours when the disposal site will be open.

10) Provide penalties for violation of the ordinance.

Conclusion

The population of the Borough has remained static, between 4500 and 5000, for the past 20 years and the refuse collection and disposal service outlined in the foregoing report should provide adequate service for the next 5 or 6 years. It will be necessary to find a new disposal site after that time which will require some adjustment, the degree of adjustment depending on the distance of the new disposal site from the Borough. This report is made to assist the Borough Council to provide the best possible sanitary refuse collection and disposal service for our local citizens at the lowest cost to them.

FLEXICROME
90% of the Cities in the United States use this ROD for cleaning sewers . . .
THERE MUST BE A REASON!
• BEST BY LABORATORY AND FIELD TEST
• SPECIAL STEEL FOR SEWER RODDING
• ACID RESISTANCE TREATED
• GROOVED COUPLINGS
FLEXICROME RODS are the end result of many years of field and laboratory tests. When you specify "Flexicrome" you get these important, exclusive features:
* Special alloy steel for extra toughness and durability.
* Heat fused rod coating for better sewer acid resistance.
* Solid center, grooved couplings for extra rod end support, and faster assembly.
Patent No. 2,471,060
FLEXIBLE INC.
3786 Durango Ave. • Los Angeles 34, Calif.
LIMA, OHIO
DALLAS, TEXAS

Acknowledgements

I wish to make the following acknowledgements for contributions to this study and report: The Borough Council for recognizing the problem before it became acute and for their foresight in authorizing a study and report to assist them in correcting the condition. The Pennsylvania State Association of Boroughs for furnishing technical publications; and Bernard F. Smith, Borough Manager at Lewistown, Fred A. Souders, Borough Manager at Hollidaysburg, and Dale F. Helsel, Borough Manager at Bellefonte, for their help in furnishing data on their experience in municipal collection and disposal of refuse.

• • •

Winter Problems in Maine

During 1959 the City of Bangor, Maine, had seventeen snowstorms and two ice storms. The total accumulation of snow was eighty-one inches. The first part of the year was very cold, and the ground was frozen to a depth of four feet in many places. The Highway Division plowed, sanded, salted and removed snow from the downtown and commercial areas of the city. In all, 1,815 tons of salt, 8,230 tons of sand, and 30 tons of calcium chloride were spread on the streets to aid winter travel. A portable steam cleaner and 150 man-days were used to thaw frozen catchbasins and culverts to avoid flooding in thawing weather. Considerable patching was done with asphalt and some sand patching during the cold weather.

Public Works Activities in Corning

The brief, but excellent, report of Public Works activities in Corning, N. Y., (Philip Grannan, Superintendent) summarizes some of the new equipment purchased during the year. This included a new garbage collection truck, a new salt spreader, a front-end loader and a small roller. Also a new garage was constructed. Mr. Grannan reports that the roller, which can be towed by the patching truck, has been especially useful in street repair and maintenance.

The Triumph of Quality

WE have been established and working commercially in the Sanitary Field since 1946.

During this time, we developed and found application for a new sludge filter; i.e., the Coilfilter, and a group of dependable auxiliaries for a successful sludge dewatering program.

Since its inception, we have built over 300 Coilfilters, the vast majority of which are doing a most creditable job for the Plant Operator.

Many Consulting Engineers have come to have complete confidence in our Company and its equipment, and we are enjoying repeat business from many of these offices.

During these fourteen years, we have seen others in the Field who have stated, "We can do it cheaper," but these efforts have not stood the test of time. We continue to outsell by a large margin all other commercial groups presently working in the Field, and this is, of course, a happy experience.

Much of our earnings are plowed back into research. Some of the new products on exhibit at this year's Federation Meeting are a result of this research and should prove interesting to those in the Sanitary Field.

We have always been a quality minded Company. Our success to date would indicate that we should continue on our course.

Respectfully,
T. R. Komline

KOMLINE-SANDERSON
ENGINEERING CORPORATION
MANUFACTURERS OF THE COILFILTER
PEAPACK, NEW JERSEY

Strength to withstand nearby nuclear blasts in the megaton range...*

Republic products go underground in Titan ICBM launching complexes

Installation of the first unit of Republic Sectional Plate Pipe connecting antenna silos to the control center.

Underground launching sites for the Air Force TITAN ICBM are a vital part of the United States' defense arm. Effective protection for these hard bases involved construction materials of many types —(reinforced concrete up to 8-feet thick, steel plates, blast doors, etc.). Products of proved performance and known quality were selected, for where the safety of our country is concerned, there is no margin for error.

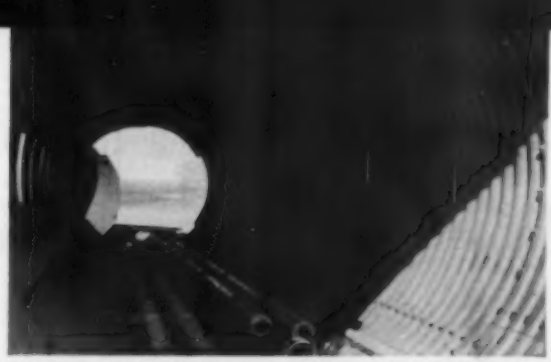
Republic Products used in the installations include: Sectional Plate Pipe, Galvanized Sheets, Bolts and Nuts, Steel Pipe, and Truscon Reinforcing Bars.

When completed, each TITAN complex (missile silos, propellant and equipment terminals, connecting-tunnel networks) will be buried under 20 feet or more of earth. The bases are designed to withstand nearby nuclear blasts in the megaton range, making the strength of basic components an important consideration.

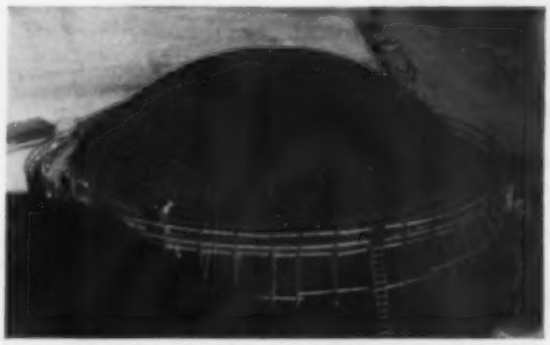
Credit for the speed and efficiency with which the TITAN bases are being made operational goes to the military planners, to the U. S. Army Corps. of Engineers, to private design architect-engineers in the employ of the military; and to the many private contractors, subcontractors, and fabricators, who have had a part in the projects. Republic is privileged to work with these groups, through district and division sales personnel, as well as through a central co-ordinating office set up to offer complete technical service and product information.

For your present and future public works projects, Republic offers a wide variety of construction and culvert products. Specify Republic and you're certain of highest quality materials, long-term dependability, and exceptional economy. Mail the attached coupon for specific information on the product lines in which you are interested.

*megaton—measure of nuclear bomb intensity. Equivalent to the energy release obtained by detonation of one million tons of TNT.



Interior view of Republic Sectional Plate tunnel connecting antenna silos to control center and power house. Republic Steel Pipe is being installed.



Truscon Re-Bars provide hard core of strength in domes of control centers, such as the one shown. Workmen are roughing in electrical system prior to concreting.

Aerial view of TITAN ICBM launching complex under construction. Republic products are being used in TITAN installations at Lowry, Edwards, Vandenburg, Ellsworth, and Larson Air Force Bases.

REPUBLIC STEEL CORPORATION
DEPT. PK-9836
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

- ☐ Sectional Plate Pipe
- ☐ Steel Pipe
- ☐ Truscon Re-Bars
- ☐ Bolts and Nuts
- ☐ Products not listed:_____

Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

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World's Widest Range of Standard Steels and Steel Products

THE HIGHWAY AND AIRPORT DIGEST

Prepared by **L. G. BYRD,** *Associate Editor*

Geometric Design of Township Roads

Township and municipal roads can no longer be laid out on the job with only obvious topographic features and existing traffic considered. As with the planning of major highways, good preliminary planning and proper geometric design can often provide additional benefits with little increase in cost over substandard designs. Geometric design refers to the design of the roadway alinement and dimensions as opposed to the structural design of the subgrade, base, slab and structures. The two existing factors, topography and traffic must first be studied and analyzed. Traffic counts must be estimated for the design year (usually 20 years ahead) and an average daily traffic for that year established.. A design speed must be adopted. With these capacity and speed factors determined horizontal and vertical alinement, superelevations and sight distances can be planned. The provision of low approach grades, good sight distances and adequate turning radii at intersections is another important feature of geometric design.

"Geometric Design of Township or Municipal Roads." W. K. Clawson, P. Eng., M. M Dillon & Company Limited, Consulting Engineers. *Roads and Engineering Construction* (Toronto, Canada), July, 1960.

Subgrade Stabilization

Lime stabilization has been the subject of recent highway research activity in Nebraska. Two base stabilization jobs were constructed with lime's principal function to correct "frost boils" and to improve plastic subgrade soils so that the design thickness of flexible pavements did not have to be increased. One job, a 12,000-ft. project on U. S. 136 built by the Nebraska Department of Roads in conjunction with the Bureau of Public Roads, is located in the southeastern part of the state where frost normally penetrates from 12 to 18 in. in depth. Annual average precipitation is 31 in,. 7 in. of which is snow. The test comprised two 6000-ft. sections, one involving base stabilization, the other subgrade. Since 1956 the test sections have performed excellently with little sign of weakness. In general the stabilized sections exhibit less deflection than standard (no stabilization bu'. 7" granular subbase added) section. The second job, on SH. 91 and built in 1958 in a potential frost boil location, attempted to prevent frost boils by 6" base stabilization. The stabilized sections have since shown excellent durability.

"Base and Subgrade Stabilization With Lime." *Rural Roads*, August, 1960.

Winter Maintenance on The Tollway

The Illinois Tollway is divided into three maintenance divisions, two of which are subdivided into three sections each, and one subdivided into two sections. Each of the eight maintenance sections, with its own building and material yard, is fully responsible for winter maintenance on its assigned roadway mileage. Basic equipment for a section includes two four-wheel drive, 32000 GVW trucks with 7-cu. yd.

6-FOOT ROTARY KEEPS CITY CLEANLY MOWED

● **PARKS, boulevards, rights-of-way and vacant lots in the City of Deer Park, Texas, are all kept cleanly mowed with this one 6-foot S.M.C. Mowall rotary mower. According to C. L. Cummins, shop superintendent of the city's maintenance department, the mower will cut anything the tractor can go over, and is very economical.**

Supts. tell why City of Jacksonville owns 7 Michigans *(5 Tractor Shovels, 1 Crane, 1 Dozer)*

"Versatile, dependable"

"We use this 2-yd Michigan Tractor Shovel for digging ditches, laying pipe, *and* backfilling. In the four years we've had Michigans, we haven't lost more than a few days work per machine due to mechanical troubles."

—Supt, Sewer Dept

"Half-day, 6-man job cut to ½ hour, 1 man"

"To move and set our old crawler-crane in position for loading at our sand pit formerly took six men half a day. Our 1¼ yd 26 mph Michigan Tractor Shovel has reduced travel to ½ hour, set-up time to nothing. In fact, Michigans are so fast and mobile our *one unit alone* handles grading, cold patching and other repairs at *all three of our airports.*"

—Supt of Maintenance, Airport Dept

"Mobile, well-built"

"Like our Michigan Tractor Shovels and Dozer, our Michigan Crane drives everywhere under its own power. We like its capacity (25 tons, ¾ yds) . . . its rugged carrier (with planetary wheel axles) . . . its good maneuverability."

—Supt, Highway Dept

"Handles landfill at 5 dumps"

"We've had our 162 hp Michigan Tractor Dozer on landfill garbage work for two years now and haven't had a bit of tire trouble. Dozer covers from three to five dumps a day, traveling under its own power from job to job."

—Supt, Street Dept

For the proof of demonstration, see your local Michigan Distributor. Or write:

CLARK EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2499 Pipestone Road
Benton Harbor 27, Michigan
In Canada: Canadian Clark Ltd.
St. Thomas, Ontario

Michigan is a registered trademark of Clark Equipment Co.

hoppers, underbody blades, front plows, and one with a right-hand wing plow. Two 28000 GVW hopper-body trucks and an average of five 22000 GVW trucks are also provided for each section. A consulting meteorologist and U. S. Weather Bureau teletype service provide forecasts and storm warnings. Salt or salt-calcium chloride mixtures are spread at the onset of a storm at the rate of 300 to 500 lbs. per mile. Plowing is done in tandem fashion using three or four trucks at 800 to 1000-ft. spacings.

"Tollway Aim: Safe Driving At Any Hour." By R. W. Kress, Maintenance Engineer, The Illinois State Toll Highway Commission, Hinsdale, Illinois. PUBLIC WORKS, September, 1960.

City Traffic Control During Construction

A detailed survey shows careful planning by most cities to minimize traffic flow problems during street or building construction programs. Miami, for instance, controls building projects, by: Specific requirements on trench openings, street

(*Please turn to page* 158)

Street Cleaning With A "City Slicker"

FREDERICK GANTER
Director of Streets,
Buffalo, New York

ABOUT three months ago Buffalo, N. Y., purchased a Tarco "City Slicker," a vacuum type litter collector, from the T. E. Potts Equipment Company, Inc. of Buffalo, for use in the street cleaning operations of the Division of Streets.

Since receiving this machine we have been using it for 16 hours a day—8 hours in our downtown sections where pedestrian traffic is heavy and where it is almost impossible to operate larger equipment to pick up litter and debris, especially in the street gutters. When not in use in the downtown area, it has been used for the additional 8 hours in the outlying business districts throughout the city. We have not experienced any maintenance problems up to this time and do not anticipate any great troubles.

This litter collector sucks up all kinds of light bulky litter, dry sand or light fine dust. The purpose of the machine is to augment cleaning work performed by power sweeping equipment.

I believe that the work of this machine will show definite savings in money since it has no brooms or brushes to wear out and needs only one man for operation. It will release our larger power equipment for more important dirt sweeping operations.

We have been very satisfied with its performance, have another one on order and anticipate the purchase of two more as soon as funds are available.

McCONNAUGHAY LICENSEES
Operating K. E. McConnaughay Emulsified Asphalt Plants

ALABAMA
Vulcan Asphalt Refining Co., *Cordova*

FLORIDA
E. A. Mariani—Emulsified Asphalt
Hooker's Point, Tampa

ILLINOIS
Emulsions, Inc.—*Lawrenceville*

INDIANA
Bituminous Materials Co.
P. O. Box 1140, *Terre Haute*
Wabash Valley Asphalt Co., *Terre Haute*
Walsh & Kelly
R. R. No. 2, *Gary*
Brookman Construction Co.
17th & Gharkey Sts., *Muncie*
Fauber Construction Co., *Lafayette*
Asphalt Materials & Construction, Inc.
4800 W. 86th St., *Indianapolis*
Bituminous Materials Co.
E. Swihart St., *Columbia City*

IOWA
Bituminous Materials & Supply Co.
409 Fifth Street, *West Des Moines*
Plants: *Spirit Lake, LeMars, Carroll, Algona, Lehigh, Davenport*

KENTUCKY
Emulsified Asphalt Co.—*Kattawa*

LOUISIANA
Bituminous Materials Co.—*Metairie*
Serving Mississippi and Louisiana

MAINE
Doherty and Swearingen Co.
53 Main St.—*Yarmouth*

MASSACHUSETTS
James Huggins & Sons, Inc.
Medford & Commercial, *Malden 48*
Koppers Co., Inc., Railroad Ave., *Westfield*

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318 Atlantic St., *Bay City*
Bituminous Materials Co., *Escanaba*
Bituminous Materials Co.
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Koppers Co., Inc., *Utica*
Koppers Co., Inc., Knight Paving Products Dept., 1655 Union Rd., *Gardenville*
Koppers Co., Inc., Knight Paving Products Dept., Vine Street, *Ithaca*
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Koppers Co., Inc., Knight Paving Products Dept., *Watertown*
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C & C Emulsions—*Van Wert*

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East Tennessee Emulsion Co.
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CANADA
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Eastern Representative:
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Hot Mix—Surface

Skid-Resistant
Emulsified Asphalt
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ALL GRADES OF ASPHALT EMULSIONS,

each the best of its type.

Be sure of fast, dependable service on asphalt emulsions and mixes by calling your nearest McConnaughay Licensee or the main office in Lafayette, Indiana

Emulsified
Asphalt Seal Coat

Emulsified
Asphalt Road Mix

K. E. McCONNAUGHAY LAFAYETTE INDIANA

EMULSIFIED ASPHALT *PLANTS AND PROCESSES*

closings; police supervision during construction; traffic engineer requirements for signing, detours, etc. Dallas, Texas, never permits complete closing of major streets and restricts work to the period between 9 AM and 4 PM. Washington, D. C., takes into account the phasing of the construction operations so traffic can be maintained without delay to construction. The City and County of San Francisco publish a booklet to serve as a guide for city and company supervisors directing projects in street areas. The Southern Building Code Congress, serving approximately 800 cities in the South and East, provides a Code used as a guide by many cities.

"Street Control During Building Programs." By Robert Dyment. PUBLIC WORKS, September, 1960.

Freeways Serve Los Angeles

The second largest metropolitan area in the United States, greater Los Angeles is predominantly dependent on rubber-tired transportation. The freeways have made a major contribution to the continuing growth of the area. Mass rapid transit has been advocated as the means to insure the future of the area, but a balanced system of both private, and public transportation should be the objective. To date many factors indicate that rail-rapid transit has a very limited potential in Los Angeles. A 1957 study by the Automobile Club of Southern California found that travel times during off-peak hours had greatly improved over those required in the area 20 years earlier and peak hour times were no greater even though vehicle registration had nearly tripled during the 20-year period. While 40 miles of freeway completed in 1953 cost about $130 million, user benefits in the seven years since completion have equalled more than twice the investment. In addition to these cost-saving benefits, property values have been enhanced by the removal of heavy traffic from parallel surface streets and safer freeway travel has saved an estimated 80 lives each year. Advocates of a rapid transit system often quote unrealistically high travel speeds without recognition of the time lost getting to and from terminals, terminal waits and station stops. Capacity figures are frequently based on theoretical rather than actual travelers moving between desired terminals at a practical time. Finally, rapid transit systems rarely represent a financial success.

"The Case for The Freeways." J. W. McDonald, Manager, Engineering Department, Automobile Club of Southern California, *Highway Highlights*, July-August, 1960.

Limited Access Highways in Urban Areas

With many miles of expressway built and even more in the planning stage, with cities "exploding," private residences and commerce and industry shifting and population growth accelerating, the urban area in the United States is undergoing vast changes. Along with these changes has come an increasing demand for modern radials and expressways to serve these areas. The 1950 census showed 64 percent of our population to be urban; by 1975, with a total expected population increase over 1950 of 70 million people, about 75 percent of the population is expected to be urban. Today with eight miles of rural highway for every one mile of city street, 42 percent of travel is in urban areas. Vehicle registrations, too,

CHICAGO USES 400 GLEDHILL SNOW PLOWS

A. W. Konefes, superintendent, bureau of equipment service, department of streets and sanitation, city of Chicago, reports that his city has used Gledhill Snow Plows for as long as ten years with good success.

ALBANY COUNTY SOLD ON GLEDHILL SPREADERS

Maurice Glockner, Albany County superintendent of highways says, "The Gledhill Sanders that we have been using of late have in my estimation been about the best and most convenient all-purpose sander to use."

The GLEDHILL ROAD MACHINERY CO., Galion, Ohio

a company built on customer confidence

Turner Heights, a typical DeKalb County subdivision paved with soil-cement. Only 8 to 10% portland cement is used, although soil is of poor quality. DeKalb County now has in service more than 1,064,000 sq. yds. of soil-cement pavement.

On DeKalb County, Georgia, streets and roads . . .

Modern soil-cement—the economic answer to urban county "population explosion"

"Soil-cement has proved so satisfactory that in the last 4 years we have annually placed this type of pavement on 12 to 15 miles of subdivision streets."

That's what DeKalb County engineers report—and it's typical of reports from many street and highway departments. One good reason is low maintenance costs. Soil-cement stays lastingly solid. That's why it won't wash out or pothole.

Soil-cement is economical to place because 75% of the materials usually are free: soil, old gravel roads—even broken-up blacktop—mixed with portland cement and water, then rolled solid. A thin bituminous topping completes the pavement!

Soil-cement is waterproof, can withstand rain the day it's placed. And core tests show soil-cement gains in rock-hard strength as it ages.

These are solid reasons why soil-cement is the fastest-growing low-cost pavement for roads, streets, shoulders, subbases, airports and parking lots.

25 YEARS SOIL-CEMENT 1935-1960

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of portland cement and concrete

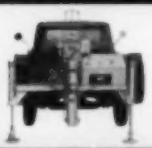
point up the growing problem with an expected increase from 70.4 million in 1959 to 101 million in 1971. Current street capacities in nearly every city of the standard metropolitan areas are inadequate, with resulting congestion, accidents, dispersal of commercial and service activities and reduction of retail sales volumes in central business districts. Comprehensive urban transportation studies have been and are being made in many metropolitan areas. Resultant planning for an integrated transportation network is then predicated on the complex and interrelated factors of population, land use and values, economic activities, travel desires and other other necessary information. In dealing with expressway design, emphasis is placed on the movement of traffic with access selected, planned and controlled. With 1,500 vehicles per hour per lane as a design standard, a six lane expressway is equivalent in capacity to fifteen lanes of city streets. Freeways also reduce travel time through increase in permissible speeds, elimination of conflicting cross-traffic movements and reduction of through traffic on adjacent streets. Safety of the urban expressway is emphasized in a recent Bureau of Public Roads study showing an accident rate only one-third that of city streets and a fatality rate of one-half. While the initial construction cost of expressways of $5 million per mile is not unusual, the cost per vehicle mile is much less than that of other roads. This long range economic picture must include recognition of the user tax revenues produced by the expressway and the stabilizing or increasing of adjacent land values resulting from freeway construction. Coordination with public transport services, comfort and convenience, public benefits and cost and financing are other factors which are given full analysis and evaluation in the development of a transportation program. Recognition of the importance of urban research and planning has brought about recent developments providing for: The proposed establishment of an Urban Research Board in the National Academy of Sciences, National Research Council; the holding of a pilot seminar on city planning for highway administrators and engineers sponsored by AASHO; and the creation of the Joint AASHO—AMA Committee to encourage cities to engage in comprehensive traffic-planning studies.

"The Merits of Limited Access Highways In Urban Areas." By Fred Burggraf, Director, Highway Research Board. *Roads and Road Construction* (London, England), July, 1960.

drill
ONE INCH
every
30 Seconds
in
steel-reinforced
concrete

with the
Mobile MARK V
Pavement Coring
Machine

MARK V is available ready mounted on Mobile custom-designed trailer



MARK V mounts on any carrier with ½ ton minimum capacity

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Hydraulic-powered MARK V is the *one machine designed specifically for production-type concrete testing.* It's the ideal drill for testing companies, municipal and federal agencies, contractors . . . anyone who wants *accurate cores, in quantity, at the lowest possible cost per foot drilled.*

- MARK V 20½' stroke easily extracts smooth, uniform cores from 2" to 10" in diameter and up to 18" in length. Drill head assembly rotates to 90° for angle drilling and highway travel. Compact, self-powered MARK V mounts in minutes on any lightweight truck or trailer. Ask about MARK V custom trailer.
- "Cushioned" hydraulic feed automatically maintains the correct drilling pressure and rate of feed . . . provides exceptional operating ease . . . absorbs drilling vibration to insure up to *one-third longer diamond bit life.*

Write for complete specifications, prices and delivery information . . .

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Maintenance Division Operation Study

Greater efficiency was the objective of a recently completed study of the maintenance division of the Maine State Highway Commission. Ebasco Services, Inc., the consulting firm making the study, dealt with the organization and operation in three sections—general maintenance, surface treatment and snow removal. For general maintenance the report recommended the elimination of the patrol system and its replacement with a crew organization—each crew consisting of a foreman, crew leader and six workers. The crew would be equipped with state-owned trucks and equipment and would be responsible for about 125 miles of road. Surface treatment would not be handled by general maintenance crews but would be assigned to special crews under division supervision. Snow removal operations were found to be excellent and no changes were recommended other than the acqui-

UTILITIES EXPECT MORE FROM

POWERS American

SERIES 460 GAS AND WATER LINE CONSTRUCTION BODY . . .

NEXT BEST THING TO HAVING NO INSTALLATION OR MAINTENANCE PROBLEMS

This body is truly a stockroom on wheels. When it arrives at the job site crewmen have all the tools, parts and supplies needed to quickly handle any routine or emergency assignment.

The quality-crafted Series 460 is available with exposed or completely-enclosed air compressor, installed behind the cab and driven by a power take-off or independent gasoline engine. Generous cargo area and specially-designed compartments, bins, trays, shelves and hooks make it easy to store and reach pneumatic and hand-operated tools, multi-size pipe, fittings, parts and bulky materials. Hose reel, backfill air hoist and water pump are optional.

Descriptive literature and prices on the Series 460 and other bodies in the Powers-American line will be supplied on request.

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Series 850 . . . another of the standard Powers-American Bodies designed for gas and water line construction and maintenance work.

Custom-made or modified-standard bodies can be furnished to meet individual work requirements . . . at prices to fit your budget.

sition of state-owned trucks for this operation. The key problems were in organization and administration where changes were recommended to: 1) Establish clear lines of authority; 2) permit delegation of authority; 3) establish clearcut definitions of individual responsibility; and 4) permit the maintenance engineer and division engineers to concern themselves with managerial and special matters rather than routine or detail work. The report emphasized that the proposed changes could be attained successfully only in stages and with all personnel fully informed of the plans and objectives.

"To Increase Efficiency." *Better Roads*, July, 1960.

Thin Sand-Asphalt Resurfacing

Resurfacing of 200 miles of main arteries is being accomplished this year by the New Hampshire Department of Public Works and Highways using a closely graded sand and medium-curing asphalt plant mix called Dix-Seal. The mix is spread in a layer of ½ to ⅝ in. compacted thickness. The sand used is a blend of fine and coarse with a maximum size under ⅜ in.; MC-5 cutback asphalt is the binder. A high mix temperature, between 300° and 340°F, is used. Costs approximate $5000 per mile.

"New Hampshire Tries Thin Sand-Asphalt Topping." By C. J. Downing, Construction Engineer, New Hampshire Department of Public Works and Highways. *Roads and Streets*, August, 1960.

Snow and Ice Control Program

With 750 miles of streets and an average snowfall of 31 inches, Des Moines, Iowa, developed a new and detailed snow and ice control program for last year's winter season. Streets were placed in three priority categories: Major arterials and bus routes; collector streets; and the remaining residential system. A chemical program on the primary system called for 800 lbs. of salt per mile of 24-ft. wide street. The abrasive mixture of 10 parts sand to one part salt is used only where the chemical alone is ineffective and at selected trouble spots. Plowing routes were laid out for the secondary and residential systems and a removal program set up for the central business district and major commercial areas. The entire program was outlined and reproduced, along with a directory of all personnel, in book form, copies of which were given to all supervisors and equipment operators. With 57.1 inches of snow in the 1959-60 winter the program underwent a severe test. With several routing problems resolved, some equipment reassignments and training of personnel to follow specific assignments, the program proved generally successful.

"A Snow and Ice Program That Works." By Arthur Grimm, Director of Public Works, Des Moines, Iowa. *The American City*, August, 1960.

Snow Removal in New York City

With 4,900 miles of paved streets, snow removal in New York City is an immense undertaking requiring the highest calibre of preparation, planning and organization. Preparatory work begins in the spring and covers: Equipment; snow removal routes and schedules; personnel; administrative procedures; assistance from other departments; and salt. At the end of the winter season, equipment is inspected and serviced. That used only for snow

How Mud-Jack® *stabilizes sub-grades*

Sunken street and highway slabs, bridge-approach slabs, settled sidewalks, curbs and gutters can be corrected — *without* costly reconstruction. Koehring® Mud-Jack pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water or water-saturated materials, raises the concrete slab, leaves firm *permanent* sub-grade. Mud-Jack comes in 2 sizes for city and highway work. Ask for a free demonstration.

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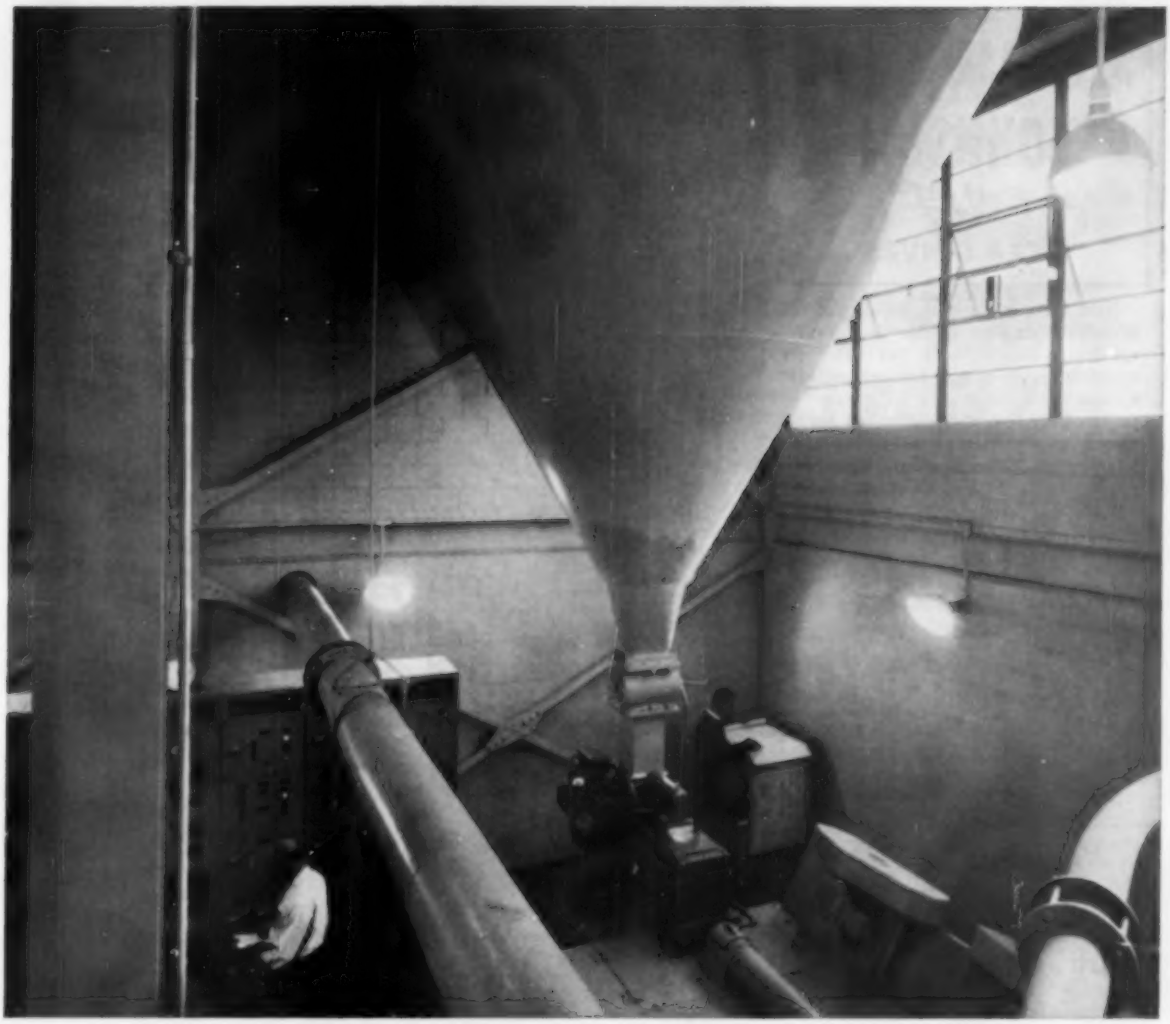

WHEN THE BEST IS REQUIRED PARLON IS FIRST CHOICE

Here's a photograph worth a million words. It shows the Chemical Feed Room at the Middlesex County Sewerage plant at Sayreville, N.J. Throughout this plant a protective coating must meet the challenge of chemical fumes. That's why Socony Paint Products Company's Sovaklor Chemical Resistant Coatings based on Parlon® chlorinated rubber were selected for walls, beams, hoppers, pipes and other equipment. Perhaps Parlon's long life, resistance to corrosion, and ability to cover almost any type of surface material can solve your maintenance problems. Your supplier of quality paint can tell you more about Parlon, or write direct to Hercules.

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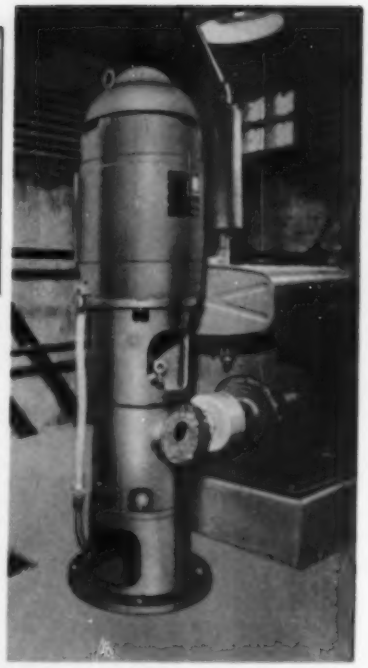

Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

Sizes: 15 to 450 hp. Johnson Right Angle Gear Drives are available in combination, dual and standard types; for all horizontal prime movers; hollow or solid shaft. Please write for engineering catalogs.

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removal is stored and periodically operated to keep it in proper-working condition. Reserve equipment is arranged for through other city departments, rental agreements and contracts for removal operations by contractors. Reevaluation is made of routes, schedules and dumping points to bring them into line with new developments. Training courses for new employees and refresher courses for older employees are conducted at Borough training depots. Arrangements are made for the use of other city department personnel and temporary employees during emergency periods. Communication facilities and weather forecast services are expanded each fall. Rock salt is stockpiled in garages and storage sheds in each borough. About 45,000 tons of salt are in storage at the beginning of the season and additional requirements are ordered, as needed, throughout the season. Storm operations follow a pattern including: 1) Salt spreading during the early part—and often throughout—the storm; 2) plowing; 3) removal of snow by sewering, scattering or flushing and piling and hauling; and 4) enforcing of parking restrictions to facilitate storm operations.

"Snow Removal Methods and Management." By Frank J. Lucia, Chief of Staff, New York City Department of Sanitation. *Street Engineering*, August, 1960.

Other Articles

"**Snow Fighters** Operate Like Military Forces." Indiana's maintenance forces are organized with military precision. By H. J. Keil, District Engineer, Indiana State Highway Department. PUBLIC WORKS, September, 1960.

"Minneapolis Sends Snow Down The River." The city has an efficient system for the annual problem of **snow removal**. By E. H. Lund, Superintendent of Street Maintenance, Office of City Engineer, Minneapolis, Minnesota. PUBLIC WORKS, September, 1960.

"Snowfall Is the Biggest Challenge of **Airport Maintenance.**" By Douglas C. Wolfe, Airport Superintendent, Detroit Metropolitan Wayne County, Michigan. PUBLIC WORKS, September, 1960.

"Sioux City Upgrades **Traffic Control.**" A systematic traffic sign survey brings favorable results. By Norman C. Barnett, Traffic Engineer, Sioux City, Iowa. Traffic Engineering, August, 1960.

"About **Salt and Chloride Stabilization.**" A discussion of the use of salt or calcium chloride for dust prevention and stabilization. Rural Roads, August, 1960.

"Better **Gravel Streets.**" San Antonio program provides new kind of maintenance. By Lynn H. Andrews, City Manager, San Antonio, Texas. The American City, August, 1960.

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There is a marked difference in reflective bead quality, determined largely by degree of whiteness and lead-free quality. On these two important factors depends the brilliance, reflectivity and ultimate performance of the product. To meet Flex-O-Lite's rigid quality standards, only the *whitest white, lead-free* beads can pass inspection. Add to this, technological advances, long experience and manufacturing know-how and you have the reasons why highway signs and markers, reflectorized with Flex-O-Lite beads, literally leap out of the darkness to contribute greater safety for the motoring public . . . greater satisfaction and economy for you. Write for new brochure today.

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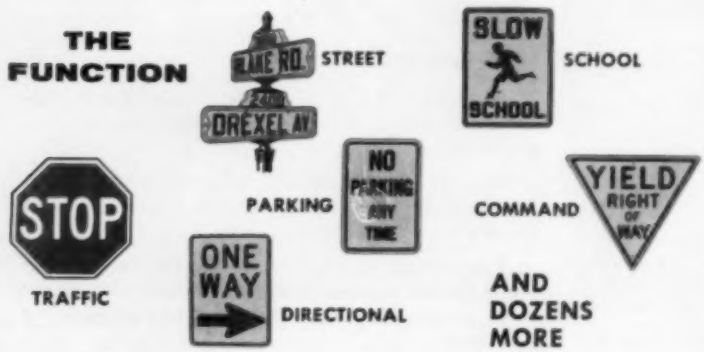

Write for Lyle's free Sign Manual and the name of your nearest Lyle Sign Representative, if you don't already know him.

Lyle SIGNS, INC.
2722 University Avenue S. E.
Minneapolis 14, Minnesota

"**Resurfacing** Old Pavements, Borough of the Bronx." By David Leibowitz, Engineer of Design, Borough of the Bronx, New York, N. Y. Street Engineering, August, 1960.

"Emerging City of Light." New York City's long-range **relighting program.** By Alexander Turkis, Chief Engineer, Bureau of Gas and Electricity, Department of Water Supply, Gas and Electricity, New York, New York. Street Engineering, August, 1960.

"How to Build Modern **Roads Over Marshes.**" By T. J. Flynn, District Engineer, American Wood Preservers Institute. Wood Preserving News, August, 1960.

"Pike Shoulders Get Emulsion Seal." **Resealing program** for penetration macadam shoulders on the Ohio Turnpike. Roads and Streets, August, 1960.

"Hi-Spec A New Approach to **Highway Planning.**" The use of air photography, photogrammetry and electronic computing provides a new dimension to highway engineering. By Ian Horder, Projects Superintendent, Hunting Surveys Limited. Roads and Engineering Construction (Toronto, Canada), July, 1960.

"Drop Inlet Structures." **Inlet designs** for erosion control. By Howard D. McMarty, Special Assistant for Soil Conservation and Erosion Control, DPWO Fifth Naval District. The Navy Civil Engineer, June, 1960.

"**Spraying Roadside** Verges." Controlling the growth of grasses by chemical means. Contractors Record and Municipal Engineering (London, England), July 27, 1960.

• • •

Training in Public and International Affairs

The Graduate School of Public and International Affairs of the University of Pittsburgh has established a new doctoral program leading to the Ph.D. degree. The emphasis is on (1) developing theoretical frameworks for the ordering of new and existing bodies of knowledge about administration in public settings; (2) discovering new knowledge and insights; and (3) developing and understanding ways by which these bodies of knowledge can be applied to the solution of programs and administrative problems in public and international affairs. More information from Dean Donald C. Stone, Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh 13, Pennsylvania.

Road Striping in Hennepin County

Centerline striping was applied to 2094 miles of Hennepin Co., Minn., roads during 1959. Of this 13.4 miles were applied by contract.

In ditch digging and ditch cleaning Gradall, with positive hydraulic control, digs to grade faster than other equipment, and without hand clean-up.

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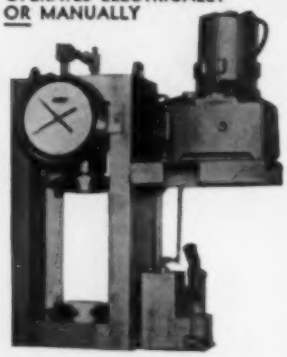

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As needs enlarge, add channels and plan holders. Same-size, attachable extensions are available. For faster reference, extra speed and system, here is the lowest priced vertical plans file.

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THE SLUMP TEST

SLUMP TESTING is one of the most widely used tests in concrete quality control. The slump test is performed on the job-site, in laboratories, in research and in teaching concrete design and control.

The correct procedure for performing the test is demonstrated in this series of photos prepared by Soiltest, Inc.

1. Equipment in readiness for the slump test.

2. The slump cone is filled in three layers, each approximately ⅓ of the volume of the mold. Each layer is tamped 25 times.

3. The slump cone is removed from the concrete and the mixture is allowed to settle as much as its consistency will permit.

4. Measuring slump with tamping rod and ruler. The distance from the top of the cone to the top of the metal form is called "the slump."

Metropolitan and Suburban Water Problem

Recent studies reported by F. L. Woodward, Director of Environmental Sanitation of the Minnesota Health Department, have disclosed that much of the ground water supplying individual wells in built-up areas, where septic tanks and soil absorption systems have been used for disposal of sewage, shows the effect of the sewage through the presence of chemicals and bacteria of sewage origin. In the Minneapolis-St. Paul metropolitan area, where some 375,000 persons are dependent on such facilities, surveys have been made of 33 communities with some 55,000 wells.

Results have ranged from no evidence of sewage in the wells of one small community to 100 percent of the wells affected in a half dozen others. The over-all results in the communities surveyed show that 50 percent of the wells tested were contaminated by sewage as evidenced by the presence of detergents or elevated nitrates.

The likelihood and extent of this condition are dependent upon several factors, such as population density, well depth, and type of soil. Deeper wells have been less affected than shallow ones, and wells in areas of dense clay are less likely to be contaminated than those in sand, gravel or broken rock.

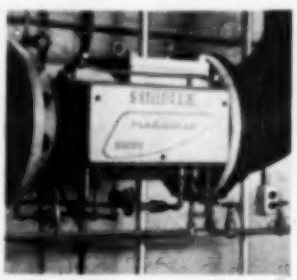
Although there have been no cases of illness reported as being caused by this situation, the presence of sewage in drinking water represents a hazard. The need is for provision of water from a safe source, usually on a community or area basis since it is more economical to build one safe water supply to serve a number of users than for each to provide his own. In addition it is necessary to plan for proper collection and treatment of sewage to avoid the ultimate contamination of the deeper water sources.

Look what you won't need with your next flow controller

NOW THERE'S A MODERN, surprisingly simple way to control flow in your filter effluent piping. The Modulair "P" rate of flow controller, fully pneumatic, installs almost as easily as a piece of pipe, gives you accuracy with less "hardware" and attention than other types of controllers.

SIMPLE! Pre-assembled unit saves you money on initial cost and installation cost. Simplicity of design reduces maintenance almost to zero. All working parts are enclosed. No hydraulic valves or valve operator. No water supply needed. No drive gears or linkage. No complicated piping. No pilot valve. No floor drain.

COMPACT! Has the shortest laying length of any rate-of-flow controller. No appendages. Shown in the picture at the right is one of three Modulair controllers at the modern filter plant in Fairmont, Minnesota. Note the trim, clean installation, with no "spaghetti" of hydraulic piping, no appendages. Unit is simply "a box on a pipe."



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Ram High Wheel Rotary

The Ram is exceptionally effective for those hard-to-get-at mowing jobs, rough terrain, ditch banks, or areas cut infrequently. High spoke wheels make it easy to handle, the Jacobsen heavy duty Hi-Torque engine gives it more than ample power. 22-inch or 24-inch cutting widths, free wheeling or power propelled.

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Produces remarkably smooth cutting, even on roughest terrain. Flexible cutting head with multiple discs permit clean cutting in heavy growth, over the roughest terrain. Three models: 34-inch and 37-inch cutting widths for all types of terrain and 48-inch cutting widths for wide turf mowing, heavy duty engines. May be equipped with electric starter-generator set, walking handle, front skids, leaf mulcher, snow blade. Send coupon for bulletin.

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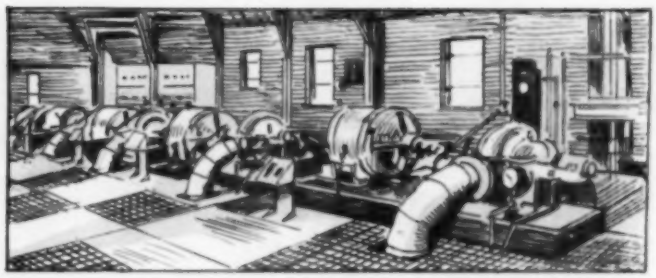


Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Industrial Water Conservation

Industries have an obligation to return process water to a stream in a condition so that it may be used by others. In-plant practices to conserve water fall into four categories: 1) Reduction in use which involves practices designed to reduce withdrawal from the water supply. 2) Recirculation of water in a closed system, particularly water used for cooling purposes. 3) Re-use of waters for a second operation. 4) Substitution of other methods which can replace the use of water. An example is the use of refrigeration in place of cooling water. The elements of an effective water conservation approach are: 1) Responsibility for the water conservation program should be well defined. 2) A survey to establish water usage is a must in any water conservation program. 3) A continuing follow-up is required to maintain an effective program. 4) Cooperation of top management and all plant personnel is required. One division in General Motors effected a reduction from 629,000,000 gallons in 1955 to 227,000,000 in 1959, an annual reduction of 402,000,000 gallons.

"How Industry Promotes Water Conservation." By L. T. Davies, Production Engineering Section, General Motors Corporation. PUBLIC WORKS, September, 1960.

Coagulant Choice

The results of a four-year study made at the Fremont, Ohio, water purification plant show that water of high purity and softness can be produced more efficiently and more economically by following a well-defined course of action in selecting coagulants. The Sandusky River, from which Fremont obtains water, drains approximately 1,200 square miles of land that is mostly flat and cultivated, and partially underlain by dolomite, limestone and gypsum. During periods of intense rainfall, water turbidities rise to 3,000 parts per million, accompanied by lower alkalinities and hardness. In dry periods, hardness rises to 700 ppm and turbidity is scarcely detectable. By utilizing jar tests for a number of years, the staff has been able to determine the coagulants that are the most effective and economical for the particular water flowing through the plant. Experience with various coagulants at the Fremont plant shows that sodium aluminate alone is particularly suitable when greater hardness reduction is required. On the other hand, ferric sulfate is superior to either alum or sodium aluminate when unusually high turbidities are encountered. A constant search is under way for coagulants that may improve coagulation and sedimentation and lengthen filter runs. Laboratory tests are being run on new agents, including polyelectrolytes, but so far none has been found which offers a decided improvement over current choices.

"Coagulant Choice —Key to Efficiency." By John S. Hess, Engineer-Superintendent, Water and Sewage Treatment, Fremont, Ohio. *The American City*, August, 1960.

Hydraulic Research

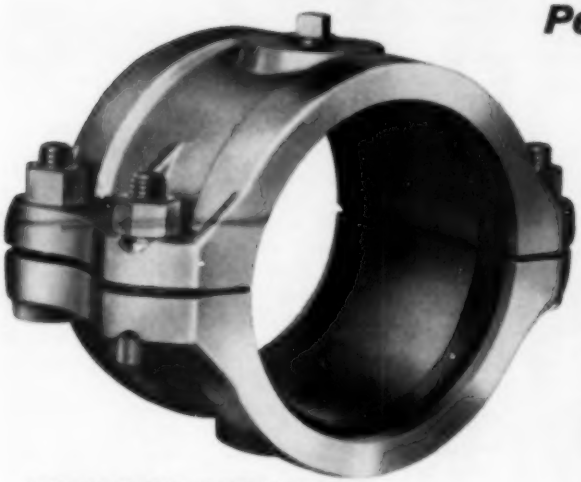
During the past decade the Iowa Institute of Hydraulic Research has undertaken a series of studies of flow in the vicinity of quasi-stable eddies produced by separation at boundary angularities. Professor Rouse described in the present paper the determination of the mean and secondary patterns of axisymmetric flow for the two comparable boundary forms: the abrupt inlet and the blunt shaft. Measurements available for analysis included the distributions of mean velocity, mean pressure, longitudinal and radial intensities of turbulence, turbulent shear and longitudinal intensity gradient. Through use of the equations of momentum and of energy for the mean and the secondary motion, the measured distributions were adjusted to yield the required balance of the essential terms in the equations, thus giving results in general accord with physical requirements. There are presented in the form of the flow patterns themselves, supplemented by curves of variation of the individual momentum and energy terms throughout the regions of separation. Of particular significance is the interrelationship of turbulence production, convection and dissipation, and the fact that a relatively small amount of turbulence energy is required locally to produce a large overall change in flow pattern. Two final diagrams indicate the variation of the terms of the Bernoulli equation extended to include the effects of turbulence and energy dissipation.

"Repartition de l'energie dans les zones de decollment." Par Hunter Rouse, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa. *La Houille Blanche*, June, 1960.

Reservoir Evaporation

The annual rainfall in 80 percent of South Australia is less than 10 inches. In this mainly pastoral area, as in many similiar regions, the effects of this low precipitation are seriously aggravated by uneven rainfall distribution and by a high rate of evaporation caused by

NEW CLOW
Ductile Iron Split Sleeve



Permits easier, quicker, permanent repair of 4", 6" & 8" transverse cast iron pipe underground breaks

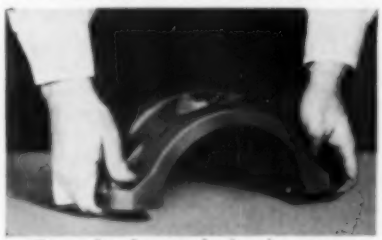
LIGHT WEIGHT Assembled 4″ diameter sleeve weighs but 26 lbs. Weight of 6″ sleeve is 32 lbs., 38 lbs. for 8″ sleeve.

SHORT LENGTH Effective length of 4 inches between end seals on all sizes. Overall length is 6¼″.

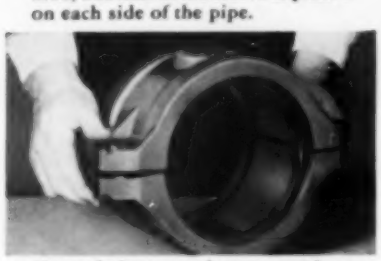
TWO-PIECE ASSEMBLY No end glands. Side and end gaskets are pre-assembled and cemented in sleeve grooves.

HIGH STRENGTH All parts are high tensile and corrosion-resistant. Sleeve halves are 70,000 psi tensile ductile iron. Nuts and bolts are high strength, corrosion-resistant alloy.

ASSEMBLED IN 3 EASY STEPS

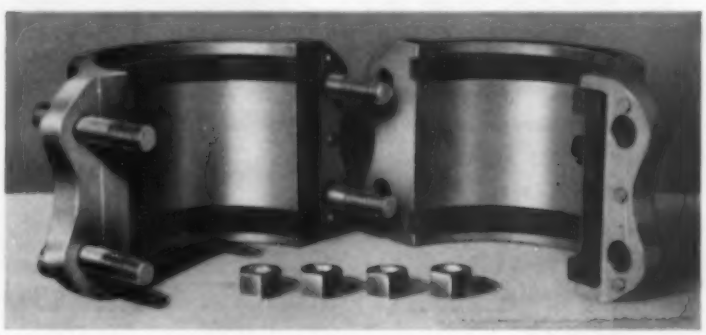


Once the damaged pipe is uncovered, one half of the sleeve is placed on each side of the pipe.



Sleeve halves are drawn together. Pre-assembled rubber gaskets make tight seal.

After the bolts are taken up finger-tight, tightening the four bolts by wrench completes assembly.



HERE'S ALL THERE IS TO IT! Illustration shows two-piece glandless construction. Side gaskets overlap ends of circumferential gaskets for tight seal. Four bolts are only accessories. Tapping boss on each half allows maximum tap of 2 inches. Regularly furnished with one sleeve-half tapped for ¾″ pipe.

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winds and elevated temperatures. The normal loss has been estimated to be four times the amount of water consumed. Experimental studies have shown that as much as 88 percent of the total capacity of storage reservoirs is lost by evaporation. Recent research, especially by the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia, has shown that the application of a monomolecular film of cetyl or stearyl alcohol will hinder evaporation. The CSIRO has developed two methods of applying the wax-like substance, cetyl alcohol, to firm a film which spreads evenly over the water surface to form a film less than one-millionth of an inch thick. The author describes the automatic and annual methods of application to small and large reservoirs. Eight to nine pounds of cetyl alcohol per square mile per day are used for large reservoirs. For small reservoirs an initial dose of 2 lbs. of the pellets per acre is sufficient with additional charges of ½ to 1 lb. per acre per month. This process for conserving water has brought about reduction in evaporation losses ranging from 25 to 70 percent.

"Reservoir Evaporation: Australian Process Cuts Losses By 25 Percent." By T.H. MacEwan, Ph. D., Marr College, Troon. *Municipal Engineering, July* 15, 1960.

Improved Solar Still

Several processes of saline water conversion are being investigated throughout the country under the sponsorship of the Office of Saline Water, U.S. Dept. of the Interior. The authors have undertaken the investigation of several new designs for the improvement of the yield from solar stills. A conventional solar still, although simple in design and operation, produces only a small amount of water per unit of area. One of the new design features is the mechanical separation of the collector-evaporator unit from the condenser. A further improvement is the use of air as an intermediate substance that substitutes forced convection for natural convection to increase evaporation. Another important feature of the new design is the reuse of energy in an external heat exchanger. On the basis of observations made and data collected, these conclusions were reached: 1) Mechanical separation of the collector evaporator unit from the condenser, plus forced convection with air an an intermediate substance, increased the distillate by 79 to 170 percent, depending upon specific design features, over the conventional solar still. 2) Forced convection effectively removed the condensate from beneath the canopy thereby eliminating losses due to absorption and reflection by the condensate. Cost estimates for design, construction and operation are included.

"Improved Solar Still Process for Desalting Sea and Brackish Waters." By Werner N. Grune, Prof. of Civ. Eng., and Iraj Zandi, Graduate Research Asst., both of the San. Eng. Research Labs., School of Civ. Eng., Georgia Inst. of Tech., Atlanta, Ga. *Journal A.W.W.A.*, August, 1960.

More Water for Detroit

The Springwells Pumping Station is one of the three major water treatment and pumping stations supplying water to the City of Detroit. The Detroit system provides water to 3.4 million people in Detroit and 49 suburban communities and contract negotiations are under way to supply water to at least 14 additional suburban communities. The Springwells Pumping Station is a complete water treatment plant which receives its raw water supply

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Radically new, powerful, transistorized locating instrument weighs only 4 lbs. and is ¼ as large as old type pipe locators.

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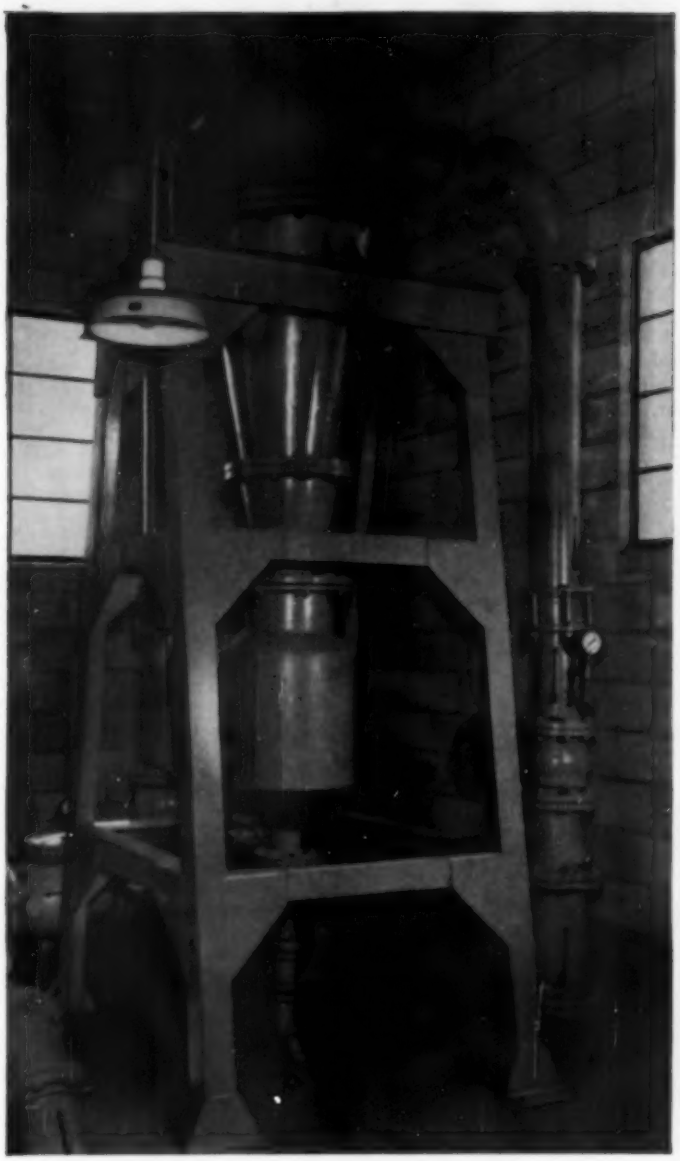

DorrClone operating as part of South Salt Lake City water system. Note simplicity of design. DorrClones have no moving parts . . . are compact and easy-to-install. A 24" diameter DorrClone like this can be designed for a maximum flow of 2,000 gpm.

DORRCLONE® REMOVES DAMAGING SAND AND SILT

from water system of South Salt Lake City, Utah

The DorrClone installed at South Salt Lake City is designed to handle 750 gpm at 125 psi. It removes sand and silt at a mesh of separation of 250-300. Since sand particles larger than 200 mesh cause the most trouble in any distribution system, using the DorrClone means fewer sanded mains and plugged meters . . . less abrasion of household appliances.

Positive, continuous desanding — without moving parts

Pump pressure is all that is needed to operate the DorrClone. Feed enters tangentially into the upper section of the unit and maintains a vortex action. Centrifugal forces, many times that of gravity, throw the sand particles in the raw water to the walls of the cone where they collect and pass downward out of the unit. Sand-free water moves to the inner spiral of the vortex . . . is displaced upward and out into the mains.

DorrClones range from 6" to 24" in diameter. They can be designed for practically all well water systems and will remove particles as fine as 500 mesh. For further information, write Dorr-Oliver Incorporated, Stamford, Conn.

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form the Detroit River through an intake lagoon. An extensive tunnel system conveys the raw water by gravity to the Springwells Station which had an original design capacity of 272,000,000 gallons per day. The capital improvement which has cost $100,000,000 over the last 10 years and which will cost in excess of $172,000,000 in the next 20 years provides for extra transmission lines with related "peak-hour storage" facilities; a raw water booster pumping station; additional treatment plant capacity; extra pumping capacity; clear water reservoirs; chemical treatment equipment; and all the necessary auxiliaries. The water treatment consists of prechlorination; coagulation with alum, sedimentation, filtration and post chlorination. Surface wash equipment allows more efficient filter washing at lower wash-water rates. Control of all phases of water treatment processes is located at the laboratory. The entire expansion program was financed by the sale of revenue bonds.

"More Water for Detroit." By Gerald J. Remus, General Manager Board of Water Commissioners, Detroit, Michigan. PUBLIC WORKS, September, 1960.

control

for algae and aquatic weeds

In small amounts, Triangle Brand Copper Sulfate controls algae growth and kills some of the more troublesome aquatic weeds. They disintegrate where they are, which prevents downstream infestation or clogged waterways.

In sewage pipes, Triangle Brand Copper Sulfate can be used in such low concentrations to control root and fungus growth that surface trees remain unaffected.

Two informational booklets, "The Use of Copper Sulfate in the Control of Microscopic Organisms," and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains," available on request.

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Other Articles

"La Nouvelle Station de **Pompage et de Deferrisation** de l'I.W.V.A. a St. Andre Oostduinkerke." The New Pumping and De-Ironing Station in St. Andre Oostduinkerke. par J. Spilliaert, Directeur General d II.W.V.A. La Technique de l'Eau, 15 Juin, 1960.

"Base-Bid **Specifications**" bring substantial water works savings to Parsons, Kansas. By Paul Freeberg, City Engineer. The American City, August, 1960.

"Tap in the Desert." This report describes the physical and political difficulties faced by Israel in securing water for irrigating the Negev. By Philip Gillon. Water & Sewage Works, August, 1960.

"Le Service Des Eaux De La Ville De Marseille." A comprehensive description of the design, construction and operation of the Marseille, France **water works system.** Techniques Et Sciences Municipales, Juin, 1960.

"Federal Research and Development Program for **Saline-Water** Conversion." A discussion of the research and development underway in the more promising saline water conversion processes. By Allen Cywin, Asst. Director for Demonstration Plants, Office of Saline Water, Dept. of the Interior, Washington, D. C. and Lewis S. Finch, Member of Site Committee, Vice-Pres. & Chief Engr., Indianapolis Water Co., Indianapolis, Ind. Journal A.W.W.A., August, 1960.

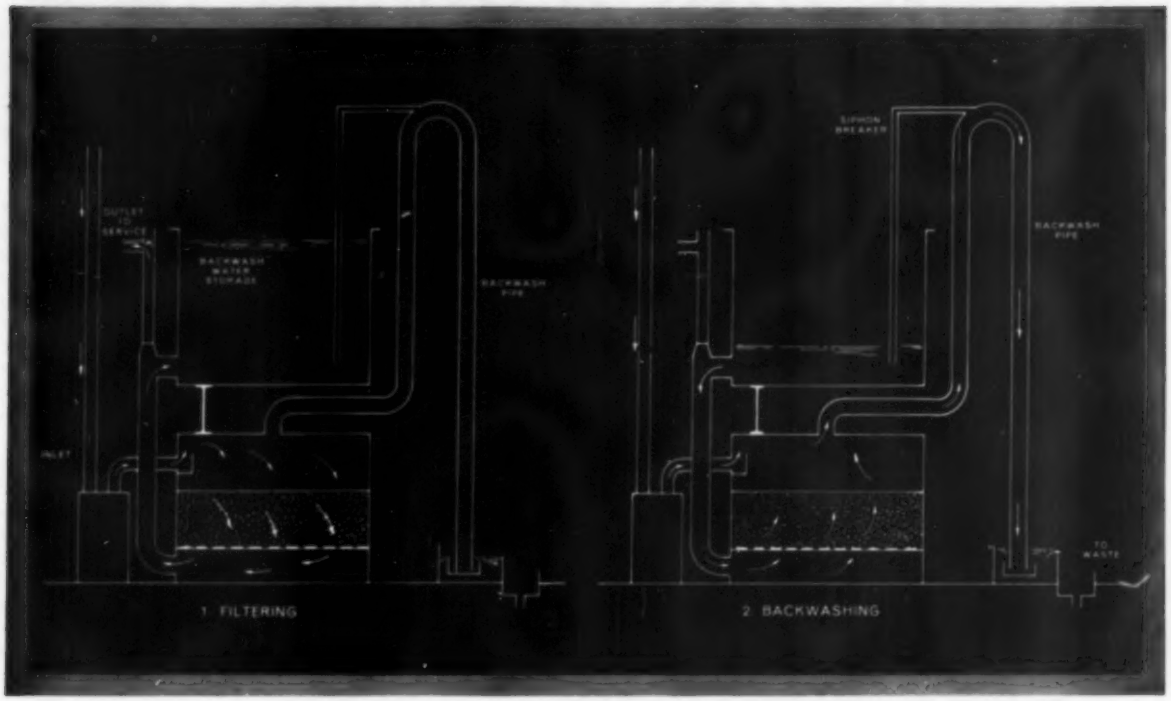
"What You Should Know About **Algae Control."** A comprehensive discussion of the use of copper sulphate as an algicide. By Kenneth M. Mackenthun, Public Health Biologist, Wisconsin Committee on Water Pollution, Madison, Wisconsin. Public Works, September, 1960.

• • •

Cleaner Air Week

The Air Pollution Control Association has issued a handbook which is designed to guide a city in arranging local observance of Cleaner Air Week. scheduled in the National Calendar of Events each year as the last full week of October. The observance is intended to further understanding of local air pollution problems, the methods being used for abatement and progress toward abatement. The handbook of the APCA suggests methods of organizing a local committee, methods of promotion including "before and after" demonstrations and a day-by-day schedule of events. The APCA will issue bulletins which can be adapted for local use. These will include news releases, speech material, TV and radio scripts and suggestions for special events. For details write Charles N. Howison, Cleaner Air Week Committee of the APCO, 2901 Union Central Bldg., Cincinnati 2.

FLUIDICS* AT WORK



How this valveless filter can save you up to 45% on initial cost, even more on operations

Even though it costs up to 45% less than conventional gravity filters, this Permutit Automatic Valveless Filter gives you your biggest savings *after* you install it.

Every day it operates, it racks up husky savings because of the steps and equipment you don't need.

The diagram here shows you how the valveless filter works. During filtering, loss of head causes water to gradually rise in backwash pipe. When it reaches 4-5 ft. above the backwash storage level, it starts a siphon action. This lowers pressure above the sand bed, reversing the water flow, and backwashing begins. Backwash continues until the level in the backwash water storage tank falls below the end of the siphon breaker. Then the siphon is broken, and the filter automatically rinses and returns to its filtering cycle.

All done automatically without a single valve, agitator, gauge, pump, flow controller—or even an operator.

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Labor costs: nil.

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Auxiliary equipment: none.

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For details, write our Permutit Div., Dept. PW-100, 50 West 44th St., New York 36, N. Y., for Bulletin 4351. In Canada: Permutit Co. of Canada, Ltd., 207 Queens Quay West, Toronto 1, Ont.

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METHODS OF COMPACTING UTILITY TRENCHES

An extract from a paper on Methods of Backfilling Utility Trenches by C. H. Palm, Senior Gas Engineer, New Orleans Public Service, Inc., before the 1960 convention of the American Public Works Association.

THERE ARE numerous types of modern backfilling equipment that are adaptable to all classes of soils and conditions. A great advantage is that most of the equipment is mobile and is able to move along the highways and streets with the rest of the traffic.

Fundamentally, there are two basic operations in backfilling trenches: 1) Placing the excavated soil back in the trenches; and 2) working the soil to a state of compression that it is at least equal to that of the surrounding parent soil.

Two of the ways of getting the earth back into the trench is by pushing it in or dragging it in. Suitable equipment for this operation are bulldozers, draglines, clam buckets, back-hoes, tractors, road graders, scrapers, etc. There are many features adaptable to each type of equipment.

Mechanical campaction equipment, suitable for use in utility construction, should be of such design that the equipment can be used in close quarters and not be an obstacle in the lanes of traffic.

The old reliable hand-tamper is still a valuable piece of equipment for backfilling small excavations or when compressed air is not available.

There are various types of pneumatic tampers. The most common type used is the single unit. Another type that is becoming very popular is the triplex hammer which is actually three tampers mounted together. The triplex tamper is so constructed that the tampers strike intermittently, thereby permitting it to be more easily manipulated. An added feature is an extension handle which permits the tamper to be operated from the top of the ditch with a depth up to 5 feet. The efficiency of the pneumatic tamper is attributed to the rapid stroke delivered.

Gasoline operated soil rammers are also available and can be used to good advantage in the absence of compressed air.

A very rugged, powerful and highly dependable machine that has proved itself efficient and economical for all types of backfilling is the hydraulic hammer. It tamps backfill to 100 percent compaction in 4 to 6-foot layers in favorable soil conditions, eliminating the need for compacting in the usual 6-inch layers. All controls are hydraulic and are conveniently located, fast, accurate and simple. An inexperienced operator can quickly learn to handle the machine. The operator can set the hammer control on automatic to deliver blows of uniform impact at a uniform rate, or he can control the hammer manually. Furthermore, by shifting to the creeper-gear, the operator can cause the machine to move automatically at a uniform speed up to 32 feet per minute. At the touch of a control, the tower tilts forward or backward, or from side to side so that the hammer strikes from the best angle. The hydraulic hammer does a precision tamping job quickly and easily and it can be driven on streets and highways at speeds of up to 26 mph. It is a simple matter to maneuver into position to do the best possible job with the greatest efficiency. The 1,000-pound hammer is hydrauli-

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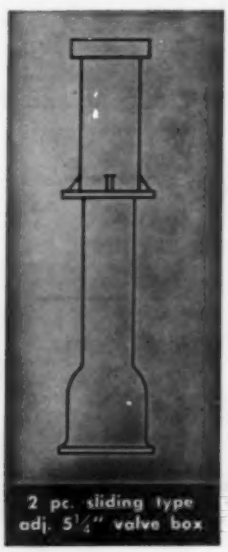
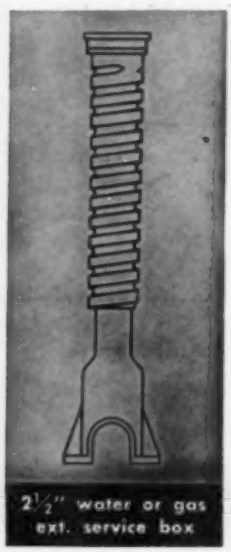
are available in every size and style!

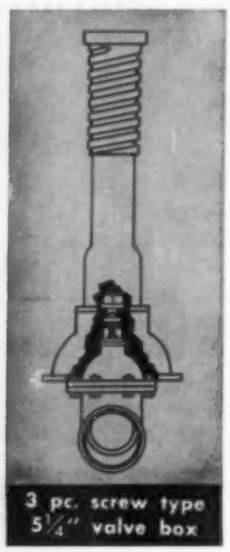
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type adj. 5¼" valve box



2½" water or gas ext. service box



3 pc. screw type 5¼" valve box

Prompt quotations given on all your standard or special gray iron or non-ferrous castings.

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"Specified and used over 600,000 feet of Transite Water Pipe."

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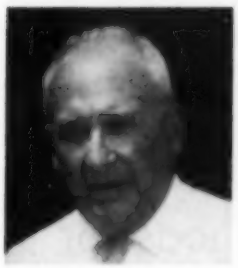
A. R. Todd and Associates, Wheeling, W. Va.



"Transite® Pipe gives our clients distinct advantage in economy," says Mr. Todd. "It is quick and easy to install, and once in service the economies continue. That's because Transite remains unaffected by external or internal corrosion, assures a tight and flexible installation for the life of the system, protects the quality of the water it carries, and minimizes maintenance and operation costs. We have found these features to be very important in an area known for highly corrosive soils and rocky terrain.

"We have specified and used over 600,000 feet of Transite Water Pipe in the past ten years on dozens of projects. We are convinced that Transite is the best value for the money. Our clients have been well-satisfied, too."

Why not let Transite help *you* reduce community water system costs? Let us send you our "Facts and Data for Engineers" book. Write Johns-Manville, Box 14, PW-10, N. Y. 16, N. Y. In Canada: Port Credit, Ontario. Offices throughout the world. Cable address: Johnmanvil.

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cally controlled to deliver any type stroke required, up to a blow of 9550 foot-pounds. One man, operating a hydraulic hammer, can do more work in less time than a crew of ten men using conventional air tools.

A combination backfiller and tamper is available and does a very proficient job. Some of the features are that it backfills fast from either side of the trench—20 passes per minute with 4½-foot scraper board; backfills clean; stays off lawns, sidewalks and completed work; and provides safer operation by working parallel to trench and to traffic. As it backfills, it simultaneously tamps the fill from the bottom up, leaving no voids around the pipe. The compaction results meet rigid density specification.

The sheepsfoot tamping roller has been developed to be very efficient on lengthy jobs and highway construction work. It is constructed with steel drums, on the outside of which are attached short metal rods, sometimes shaped similar to a sheep's foot. The feet vary in number and are staggered to distribute the weight and give better tamping effect. It is assembled in units of one or more drums, each weighing approximately 2,000 pounds. Provisions are made for filling the drums with liquid, sand or other material in order to add to the weight.

The addition of a metal frame, through which the drums revolve, in conjunction with cleaner blades, eliminates the accumulation of mud and dirt. The frame assembly also helps to stabilize the roller. The bridle connection is stationary on a bulldozer, but is connected to a tongue or tow-bar, with a swinging hitch. This latter type connection maintains stability of the sheepsfoot in the trench as it allows both vertical and horizontal motion. Particularly is this true and necessary as the elevation of the backfill in the trench reaches the normal surrounding ground level. It is a common practice to "walk the machine out of the ground," that is, making trip after trip over the backfill until the feet no longer penetrate. In average dirt, 10 to 15 trips over the same area will usually give the required compaction. A travel speed of approximately 3 miles per hour is used. Actual field studies in various sections of the country have revealed that this method is the most economical type of compaction.

Another method of compaction results with the use of rubber tires on the equipment or rubber tired rollers. It is claimed that units of this kind will reduce voids and increase compaction.

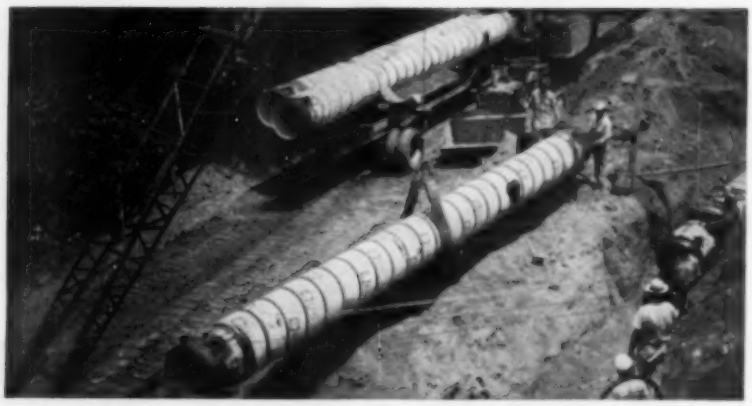
• • •

Methods for Decontaminating Water

THREE METHODS of removing radioactive contaminants from drinking water supplies have been successfully tested by the U. S. Army Corps of Engineers. The Sanitary Engineering Branch of the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., has reported favorable results using a standard purification unit consisting of chemical coagulation and diatomite filtration, the "Erdlator," a mobile exchange unit and an electrodialysis demineralization process.

Tests were conducted at the Nevada Test Site within proximity of the area where the atomic bombs

ATLANTA *chose* STEEL PIPE



. . . every length was hydrostatically tested in the shop to AWWA standards!

To provide for industrial and residential expansion in South Fulton County, Atlanta Water Works installed an additional 8,200 ft. of steel pipe along Fairburn Road. This new line incudes 2,916 ft. of 36 in. pipe and 6,200 ft. of 30 in. pipe, all with 5/16 in. wall thickness and in 50 ft. lengths.

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LONG LIFE

. . . these are inherent qualities of fabricated *steel* pipe. Compare *steel* pipe with other types . . . you'll see why "wherever water flows, steel pipes it best." You can always specify *steel* pipe with confidence.

For your copy of the latest steel pipe brochure, write—

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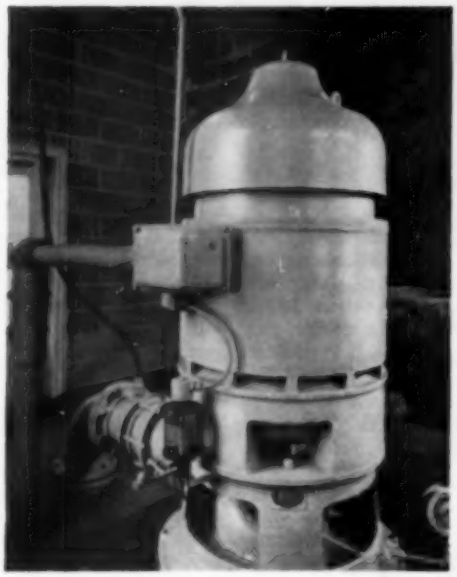
"We have found Peerless pumps consistently more efficient and longer lasting than any other pump we have used."

Says Joseph Kuranz, Manager, Waukesha Water Utility, Waukesha, Wisconsin



←"Even at our settings (400-500 feet) and with the severe abrasive action of the water bearing aquifers in our hard water area, we plan on getting 10 years service from these deep well turbine pumps before they need maintenance attention. And when we do remove a pump for inspection, we find there is notably less damage from abrasion in the Peerless equipment."

▲ In addition to the deep well turbine pumps, Peerless Type A booster pumps are in use at four stations. Capacities are approximately 1000-1200 gpm against heads of 170-180 feet.

PEERLESS PUMPS

Standardize on Peerless pumps for all your water supply and pumping needs. Like the Waukesha Utility, you'll find Peerless pumps last longer, cost less to maintain and do the job better. For full details on Peerless pumps for your application, write us or clip coupon below.

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PW

were formerly tested. The Office of Civil Defense Mobilization participated in all the tests.

Radioactive soil specially ground to a very fine particle size to stimulate radioactive fallout was added to a water source giving a contamination level of 660,000 units (micro microcuries per liter). After treatment in the Erdlator, the contamination was reduced to 5000 units. This is far less than the 300,000 units which is considered a safe emergency drinking water tolerance. The contaminated soil was essentially insoluble in water and thus the water treatment process, which is designed to remove suspended material from water, was very efficient.

Because some radioactive materials are also soluble in water, tests were conducted with specially prepared contaminants 100-percent soluble in water. Strontium 90 and Yttrium 90 were dissolved in the water source giving a contamination level of 1,800,000 units. To reduce these contaminants to an acceptable drinking level, treatment with the ion exchange unit was required as a follow-up to the Erdlator treatment to produce a finished water of 830 units. These tests were repeated, using almost one curie of soluble Cesium 137 with contamination of the water source to 12,700,000 units. The Erdlator and ion exchange treatment in series reduced the level to 2000 units. Cesium 137 contaminated water was also treated in the electrodialysis process which consistently produced a drinkable water of approximately 12,000 units.

Other water treatment processes tested included chemical coagulation followed by a sand filtration similar to municipal type filters, and a resinous water softening process which was typical of many home water softeners. The performance of the sand filter was equal to the diatomite filter in removing the insoluble contamination and the home softener was found capable of removing approximately 90 percent of the soluble strontium 90.

An important part of the field tests was to measure the radioactive build-up in the equipment, especially those sections in which the removal process concentrated the contaminant. Results indicate, that in the continuous flow systems not requiring constant operating attention and with the levels of contamination handled in these tests, an operator can satisfactorily perform his duties without special personal shielding. Furthermore, the bulk of all the equipment was satisfactorily decontaminated so that it could be reused.

Both the ion exchange and electrodialysis processes have dual functions as water treatment equipment. In addition to their water decontamination capabilities, they were tested at the site for the demineralization of a brackish ground water supply. Each unit at design capacity reduced the dissolved mineral content of a deep well water supply to the level acceptable according to current drinking water standards.

The ion exchange process used in these studies was a self-contained unit mounted on a standard 2½-ton truck chassis recently developed for military field service. Installed in the truck van body are conventional ion exchange pressure filters containing synthetic ion exchange resins which, when chemically exhausted, are regenerated in the field for further service. The electrodialysis process was a commercial type experimental unit modified for field operation. The unit consisted of a stack of selective ion exchange membranes to which electric power from a field generator is imparted to furnish energy for removal of dissolved ions from water.

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Meter men know their settings		**1. You Standardize Your Settings** Regardless of the model, Ford yokes and setters provide standard, permanently aligned settings. No time lost trying to "rassle" around with the odd ones.
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You get the breaks on new inventions		**7. Ford Research Keeps You Out in Front** For over 60 years Ford has specialized in developing and producing better equipment for setting and testing water meters. Stay "out in front" with Ford.

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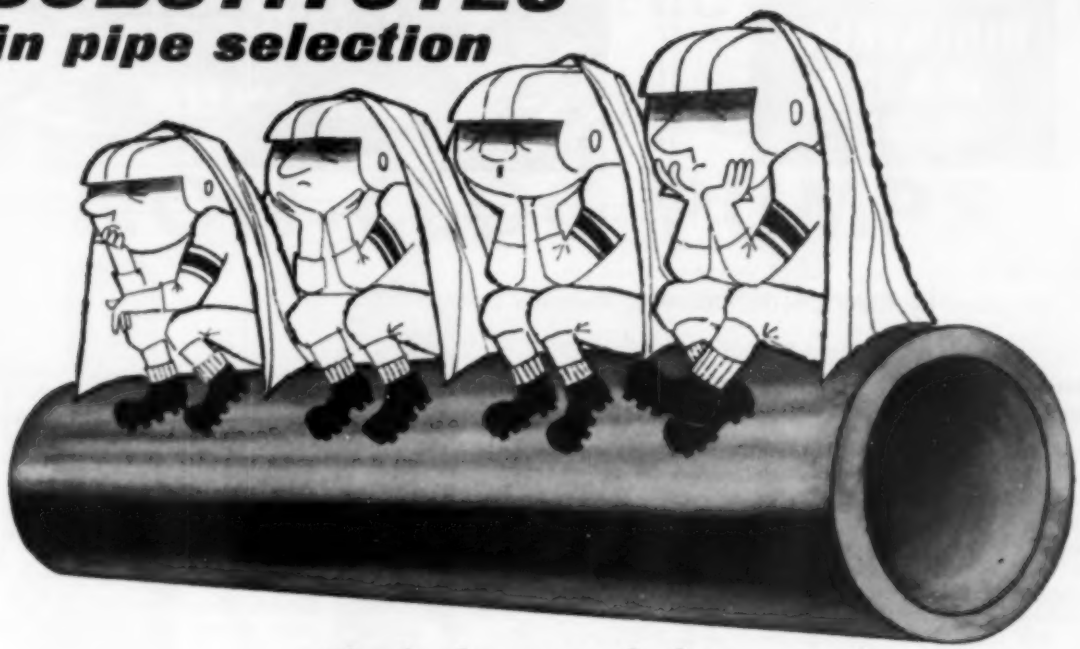
no place for SUBSTITUTES in pipe selection



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Bursting Tensile	25,880 psi	3,430 psi
Impact Resistance	234 ft. lbs.	60 ft. lbs.
Beam Loads (12-foot span)	20,790 pounds	3,060 pounds
Crushing Loads	17,900 lbs. per ft.	6,480 lbs. per ft.
Water Absorption	None	9.8% of weight after 24-hour submersion
Tight Joints	Wide selection for liquid or gas service	Limited selection for water service
Inside Diameter	6.14"	5.85"

Pipe tested were 6" Class 150.

AMERICAN CAST IRON PIPE CO.
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THE INDUSTRIAL WASTE DIGEST

Prepared by CLAYTON H. BILLINGS, *Associate Editor*

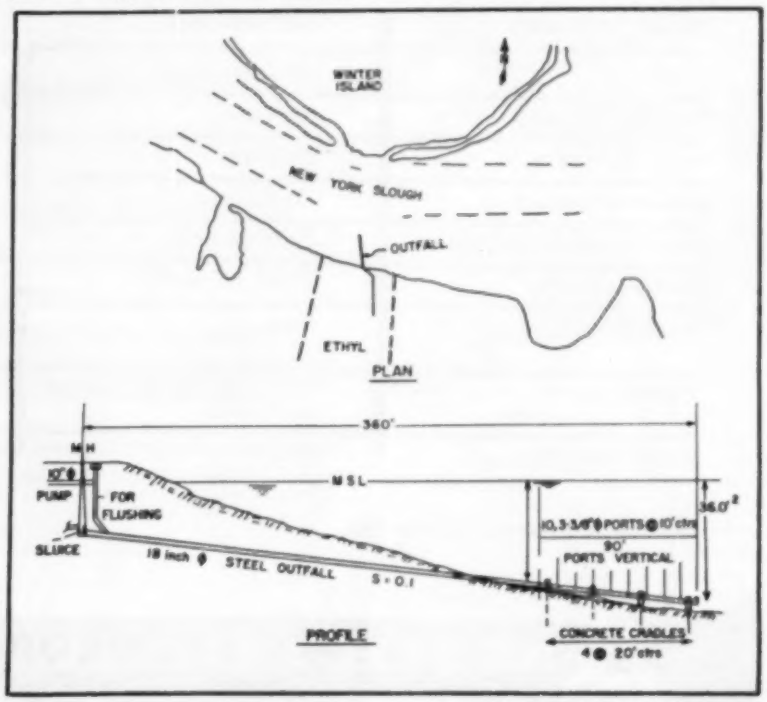
Submarine Dispersal of Chemical Wastes

One of the initial steps in locating a new tetraethyl lead production plant of the Ethyl Corporation at Pittsburg, Calif., was to obtain approval for discharge of wastes to New York slough, located at the confluence of the San Joaquin and Sacramento Rivers in the San Francisco Bay area. Water quality criteria were established to protect domestic water supply uses during high stream flow, sports uses and navigation. A treatment plant is to be provided to recover lead, remove suspended solids and adjust pH. The treated waste is expected to contain nearly 18,000 mg/L of sodium chloride and sulfate and various forms of lead totaling 18 mg/L. The dispersal system has to take into consideration conditions throughout the tidal cycle and the amount of fresh water available. In designing the outfall Pearson's formula was used for estimating dilution achieved by jet mixing. This indicated that a 30 to 1 dilution would occur from using diffuser ports 3⅜ inches in diameter. The terminal portion of the 360-ft. submarine outfall was constructed as a multiport diffuser with 10 ports spaced at 10-ft. centers. It was assumed that dispersion occurs to an average water depth of 15 ft. and in a stream ranging from 1.5 to 2.5 fps during most of the tidal cycle, resulting in an average dilution in the area of 1,500 to 1. A monitoring program was undertaken to analyze the waters and stream bed for base line characteristics. The monitoring will be continued after the outfall has been placed in operation to assess compliance with water quality criteria.

"Submarine Dispersal System for Treated Chemical Wastes." By J. M. Gill and J. H. Huguet of the Ethyl Corporation and E. A. Pearson, Consulting Engineer. *Journal Water Pollution Control Federation*, August, 1960.

Air Pollution Court Decisions

The technical and legal means are available to control air pollution but only rarely does the control seem to be adequate. Only a dozen states have enacted specific legislation on the subject. The problem was recognized by the Congress in 1955 and subsequent years with periodic appropriations to support research and technical assistance to the states. Municipal ordinances are adequate to cope with the problem in only a fourth of the cities affected. Courts have almost invariably upheld the validity of the State's exercise of police power in air pollution cases. These were reviewed in the October, 1957 issue of PUBLIC WORKS. Since then the United States Supreme Court and state courts have made important decisions. The Supreme Court has twice held that air pollution control is subject to state jurisdiction, the latest ruling occurring in 1960 with two of the justices dissenting. In several other cases the Supreme



Courtesy Water Pollution Control Journal

● **SCHEMATIC layout of submarine dispersion system designed to create minimal pollutional effects from industrial wastes discharged into arm of San Francisco Bay.**

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NON-CLOG PUMPS

TYPE KUC VERTICAL—For compact installation with flexible coupling drive... motor high above floor.

TYPE KCM VERTICAL—Utmost compactness... close-coupled design... low suction.

For handling heavy liquids . . . and solids in suspension. Ideal for public utility and industrial wastes.

Capacities to 9000 GPM • Heads to 150 feet • Solids size to 6 inches

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- Easy Disassembly
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- Many optional features available
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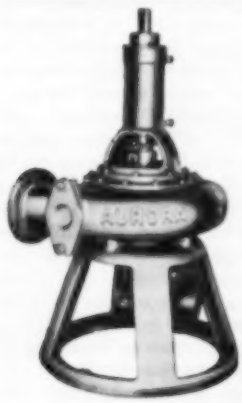

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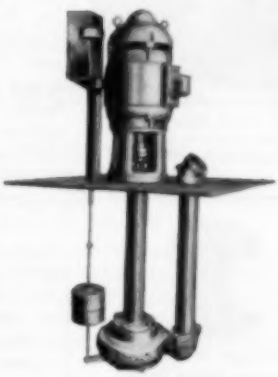
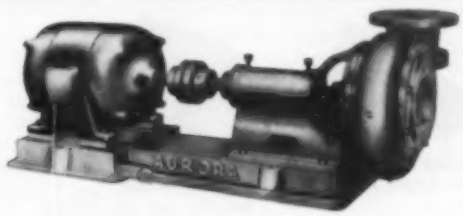


TYPE KS VERTICAL SUMP—For heavy duty wet pit service. Complete unit engineered to specific pit requirements.



TYPE KGG HORIZONTAL—Rugged base mounted unit ...for use where suction conditions permit horizontal mounting.

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Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

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Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

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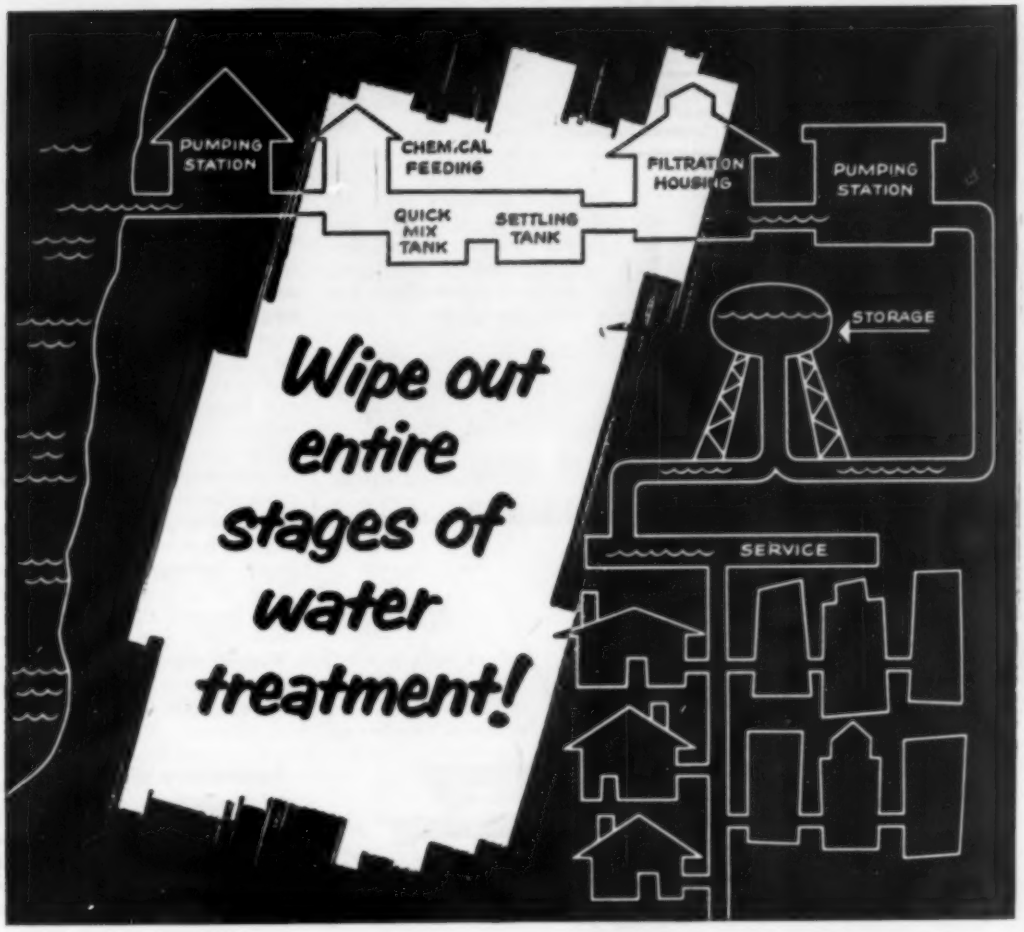
Court has refused to review the findings of state courts and lower Federal courts, allowing local convictions to stand. These have shown that property owners are liable for allowing smoke emissions on privately owned dumps, that enforcement of the Los Angeles County air pollution code against industrial firms is a valid exercise of power and that damages may be recovered from injuries received as a result of emissions from industrial plants in cases in Oregon and Utah. In the Oregon case it was ruled that negligence did not have to be proven. However, in a Pennsylvania case it was ruled that no liability existed for fumes or noxious gases. In general it appears that while every citizen has the right to pure air, this right may be qualified by local circumstances. If he chooses to live in an industrialized area, he must expect to suffer some discomfort if the industries are negligent.

"Air Pollution and the Courts." By James A. Tobey, member of the New York Bar. PUBLIC WORKS, September, 1960.

Standard Pilot Plant Procedure

The use of standard procedures in any analytical work allows the ready comparison of data acquired. While a standard exists for analysis of water and wastes, there is a need for uniform procedures in pilot plant techniques employed in research to permit data to be comparable in all detail. A standard pilot plant procedure is suggested for determining the treatability of a waste by aerobic biological methods. The raw waste should be analyzed for COD, BOD, nitrogen, pH, phosphorous and trace elements. In addition an acid-base titration curve will permit judgment of the waste's buffer capacity. The pilot plant should be a batch-fed, fill-and-draw type of aeration unit. A lucite, 7.5-liter, five-compartment unit with porous stone diffusers can be built for $25. Treatability in general can be ascertained after a build-up of sludge on a substrate similar to the waste being tested. Initially this sludge should be 1,500 to 2,000 mg/L of suspended solids. The initial waste feed should be 1,000 mg/L per day in terms of COD, with the aeration period, 23 hrs. If a COD reduction equivalent to that obtained with the similar waste is achieved, the waste is judged treatable. If not, the sludge should be built up progressively and the waste diluted with the similar material. The COD of the substrate is period-



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Now you can do something about skyrocketing per capita water consumption costs—as are dozens of municipalities every year. And get clearer, sparkling-bright water in the bargain!

Install one of today's small compact diatomite filtration plants, using Celite* filter aids. In many cases, raw water can be filtered directly, eliminating several of the costly conventional pretreatment stages—flocculation, quick-mixing tanks, and settling tanks, for example.

Result†: Filtration plants requiring only ¼ the space of sand plants of equal capacity. Capital costs cut almost in half—savings of up to 45%.

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* Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

† See *Comparison Studies of Diatomite and Sand Filtration* by G. R. Bell, Journal American Water Works Association, September, 1956, or write for free reprint.

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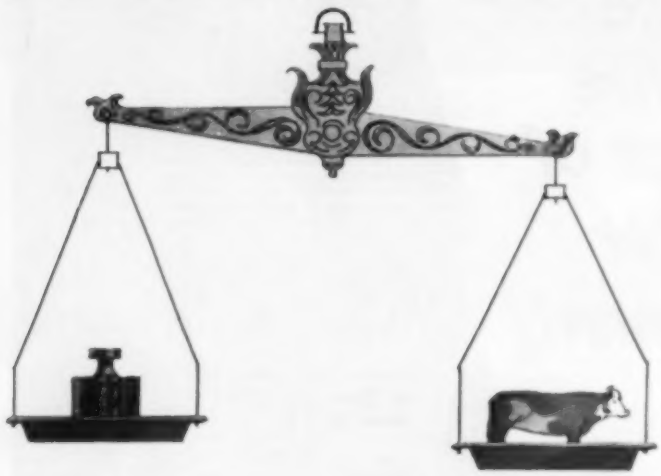
ically checked and if it remains high after 20 days, the waste is considered untreatable. With toxic wastes, the system may require modification to continuous feed. Control tests should be run, including total and volatile mixed liquor solids, pH, soluble COD and microscopic examinations for bacterial life.

"A Procedure for Determination of the Biological Treatability of Industrial Wastes." By J. M. Symons, R. E. McKinney and H. H. Hassis. Massachusetts Institute of Technology. *Journal Water Pollution Control Federation*, August, 1960.

Flotation for Oil and Detergents

Aircraft maintenance involves frequent disassembly and cleaning of parts for inspection, and the cleaning operations produce large volumes of water-borne wastes. The predominant cleaning agents are petroleum solvents and detergents. To solve the problem of disposal of these wastes at the United Air Lines Maintenance Base at San Francisco, the firm of Kennedy Engineers was engaged. It was found that the average workday flow was 190 gpm with peaks of 290 gpm. Characteristics included total oil, 500 to 1200 ppm; emulsified oil, 250 to 700 ppm; BOD, 400 to 800 ppm; suspended solids, 70 ppm; volatile solids, 40 ppm; and pH, 6.8 to 7.2. Tests using pilot scale equipment indicated that pressure flotation preceded by coagulation with liquid alum and activated silica would be effective. In the pretreatment, storage unit of the plant as built, flow is equalized and free oil is removed by skimming. The flotator system operates with a constant pressurized feed volume withdrawn from the bottom of the pretreatment tank. The alum and activated silica are fed into the suction of the pressure pump. A scum concentration tank was provided with decanting valves, to reduce the scum volume for tank truck disposal. A year's operation experience has been obtained with production of an acceptable effluent. The Flotator was selected on the basis of a loading of 3,000 gpd per sq. ft., but it now operates at rates up to 6,000 gpd per sq. ft. with less than 20 ppm oil in the effluent.

"Chemical Coagulation and Pressure Flotation for Aircraft Oil Wastes." By E. J. Mahood, Kennedy Engineers. *Wastes Engineering*, August, 1960.



For Value Received

Should price be the sole measure of the value of any product? In almost any business—whether it's "ships, shoes or sealing wax"—you can find some one who will reduce its quality if you require him to reduce its price.

British philosopher John Ruskin once said: "There is hardly anything in the world that someone cannot make a little worse and sell a little cheaper—and the people who consider price alone are this man's lawful prey.'

Much credit for the rapid growth of M & H belongs to customer-good-will, customer-confidence, and an extraordinarily healthful customer relationship. Due to a combination of fair dealing, improved product-design, quality materials, delivery schedule-integrity, and honest prices, M & H customers over the years have developed a sense of loyalty to the Company. They simply like to do business with M & H because a basic principle of the Company's sales policy is that the price paid for an M & H product is only one factor of the value the customer receives.

Practical, efficient, dependable field service of M & H products goes on year after year—long after the price is forgotten. No wonder that M & H business volume has grown and grown, and inevitable leadership in the industry has come to the Company and its products.

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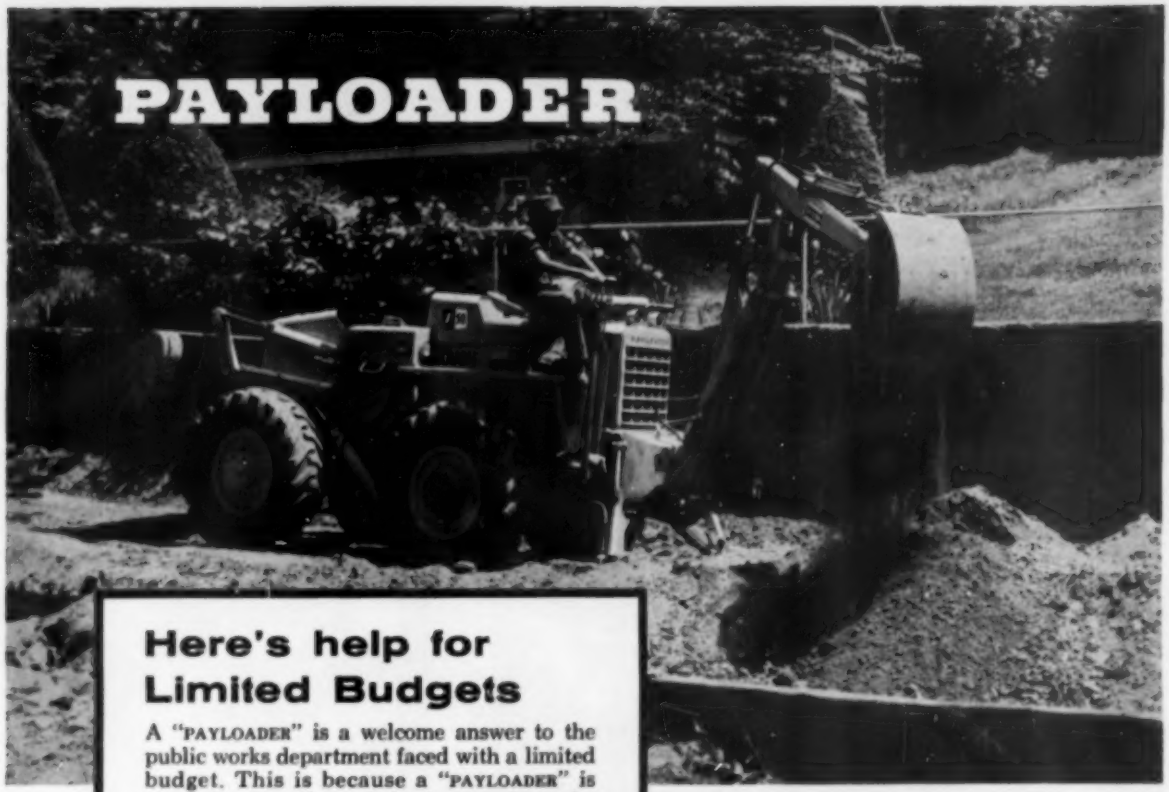
Radioactive Wastes In Britain

There are only two methods of dealing with radioactive wastes: 1) Concentration and containment or 2) dispersal to the environments. The first alternative, though ideal, is not practicable. The increasing use of radioisotopes and development of power from nuclear energy, therefore, must mean the natural radioactivity of the environment will be increased by waste discharge, and it is essential that the discharge be controlled. That present controls are effective is borne out by the lack of any incidents occurring resulting in known hurt to anyone. In Great Britain the various establishments of the United Kingdom Atomic Energy Authority present the major share of the problem. Most important are the wastes from processing spent nuclear fuel by nitric acid solution of fission products and impurities in reactor fuel. The level of activity is 10 to 15 curies per liter. The Research Establishment at Harwell presents the next important problem; one reason is the necessity for discharge of liquid effluents to the Thames, the main source of London's water supply. Among disposal methods in general, much thought



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Consider this Model H-50 with a Drott "4-in-1" Bucket on the front and a Wain-Roy Backhoe on the rear. The "4-in-1" can do shovel, bulldozer, clamshell and scraper work — is an exclusive-on-rubber on "PAYLOADER" units. The backhoe can dig trenches, bell holes, etc. up to 12-feet deep — even at right angles to the machine — and can do a variety of crane operations.

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Model H-50 PAYLOADER with rear-mounted Wain-Roy Backhoe digs trench for water main, and

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has been given to separation of long half-life fission products from spent atomic energy fuel wastes, but normal chemical processes seldom yield more than 99 percent. Fixation of the wastes in solid form is more promising. This can be achieved by mixing the waste with clay and firing the mixture at temperatures above 1,000°C. A ceramic product is formed, which would present little risk of contaminating the ground or water. Storage of the wastes deep underground offers factors of safety, using abandoned mines, particularly salt mines and deep and porous underground formations. The effluent discharge to the Thames is controlled to not exceed one tenth the maximum permissible concentration for water. For discharge to sewers, in most cases, the safe limit is an ultimate concentration in sewage of 10^{-4} microcurie per ml. Burial of solid wastes should avoid contamination of ground water and not interfere with any future use of the land. It does not seem advisable to deposit more than 100 microcuries per month of radioisotopes with half-lives greater than a year. Solid wastes enclosed in containers have been dumped at refuse tips. Care should be taken to bury such containers under 5 feet of other material. The dose rate on the surface of the container should not exceed 20 mr per hour. With the problem continually increasing, the solution may be a national disposal service which would call for a national disposal site.

"The Safe Disposal of Radioactive Wastes." By R. H. Burnes, Chief Industrial Chemist, Atomic Energy Research Establishment. *Royal Society of Health Journal*, July-August, 1960.

Calcining Reactor Fuel Wastes

The first large scale fluid bed unit for calcining aluminum type fuel wastes from test reactors is being built at Arco, Idaho. An aluminum nitrate solution resulting from treating the fuel with nitric acid, is sprayed onto a fluidized bed of aluminum oxide particles to remove water and nitrogen oxides. The remainder becomes granular aluminum oxide. The rate and the manner in which dehydration and decomposition occur were investigated. It was found that above 200°C. the chemical reaction is so fast that physical rather than chemical forces controlled it. Consequently, fluid bed designers may be governed by known methods for heat transfer and heat balance. Atomization of liquid feeds is important in preventing agglomeration of unreacted aluminum nitrate.

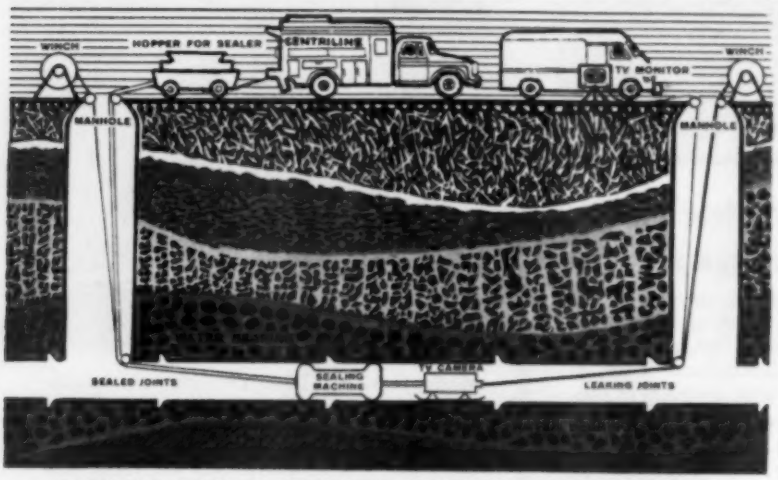
"Fluidized Calcination of Simulated Aluminum-Type Wastes." By J. D. Jackson, H. A. Sorgenti, G. A. Wilcox and R. S. Brodkey, Ohio State University. *Industrial and Engineering Chemistry*, September, 1960.

Other Articles

"Colorimetric **Determination of Phenolic Materials** in Refinery Waste Waters." By G. E. Gordon. Using silver nitrate to remove sulfides from water samples containing phenol is faster and believed to be more accurate than previously accepted methods. Analytical Chemistry, September, 1960.

"Evaluation of **Plastic Trickling Filter Media.**" By John T. Egan and McDewain Sandlin. Plastic media have definite application in the treatment of pulp mill wastes and appear to have many advantages. Aerobic thermophilic treatment is possible. Industrial Wastes, August, 1960.

"The Oxidation of **Pyritic Conglomerates.**" By S. A. Braley. The basic mechanism for the production of acidity in mine wastes is revealed by studies. Industrial Wastes, August, 1960.



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Now joint leakage can effectively be stopped in small as well as large sanitary and storm drains. By remote control—constantly monitored by television which finds the leaks and checks the seal afterwards—special CENTRISEAL PROCESS equipment forces a fast-setting polymeric sealer into open joints **from the inside.** This forms a tough seal in the pipe joint as well as outside in the surrounding soil. You're thus assured a permanent bond, and leakage from either internal or external pressures is prevented. No excavations are necessary and the grouting process is remotely controlled from above ground. Savings are found in maintenance and pumping costs and capital expenditures are avoided.

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In Newton and West Newton, Mass., Capello Bros., Inc. serve some 40,000 residents with twice-weekly residential and daily commercial refuse disposal under a 3-year contract with the cities. Mr. Pat Capello, co-owner, says complaint calls have been cut from 100 or more to less than 4 a day since 1958 when his firm won the contract with 12 Hydro E-Z Packs. "Our clean, efficient, odorless E-Z Pack service protects our nearly ½ million dollar contract and saves up to 15% on operating costs," he said. The savings estimate is based on reduced travel time and maintenance economy. "We haven't had one minute of 'downtime' in 17 months," Mr. Capello said.

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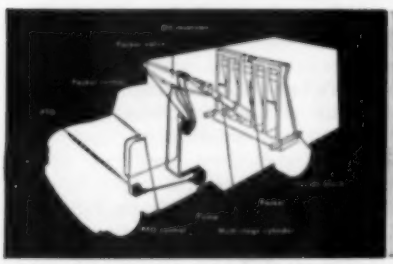
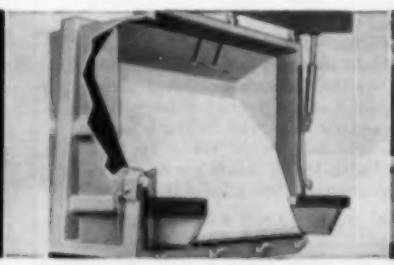


Simplest of all disposal bodies with the fewest working parts. No complicated chains, conveyors or whirling knives.



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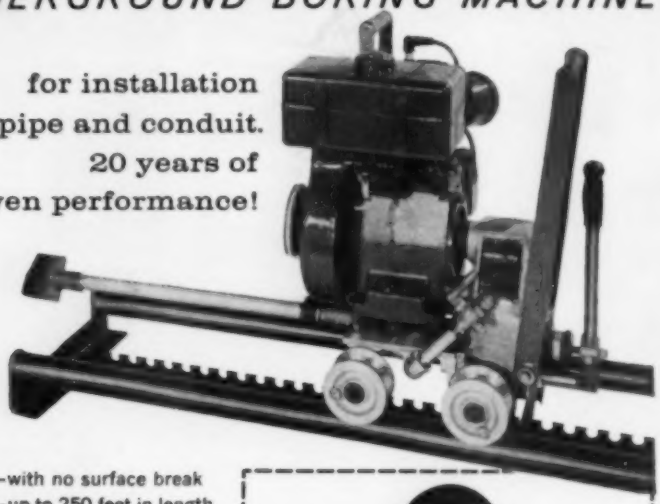

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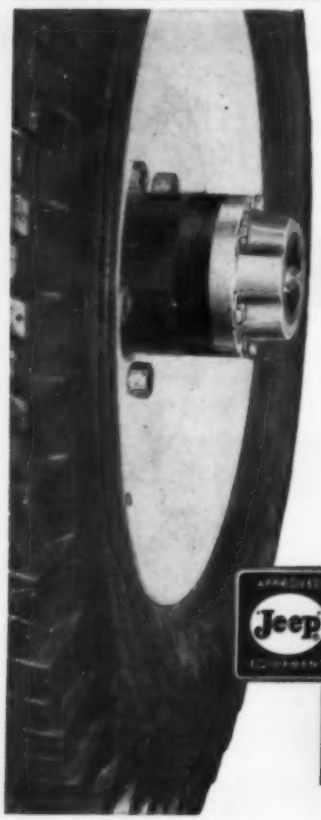

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USED ON OVER 200,000 4-WHEEL DRIVES!

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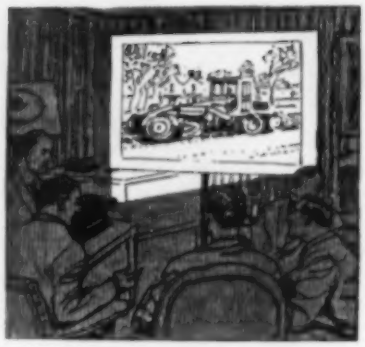
"An Automatic **Hydrogen Fluoride Recorder** Proposed for Industrial Hygiene and Stock Monitoring." By Donald F. Adams. Fluoride levels in the range of 0.1 to 200 mg. per cu. meter may be determined continuously by measuring the color produced by the reaction between fluoride and the green ferron complex and using an automatic recorder. Analytical Chemistry, September, 1960.



FILMS in Brief

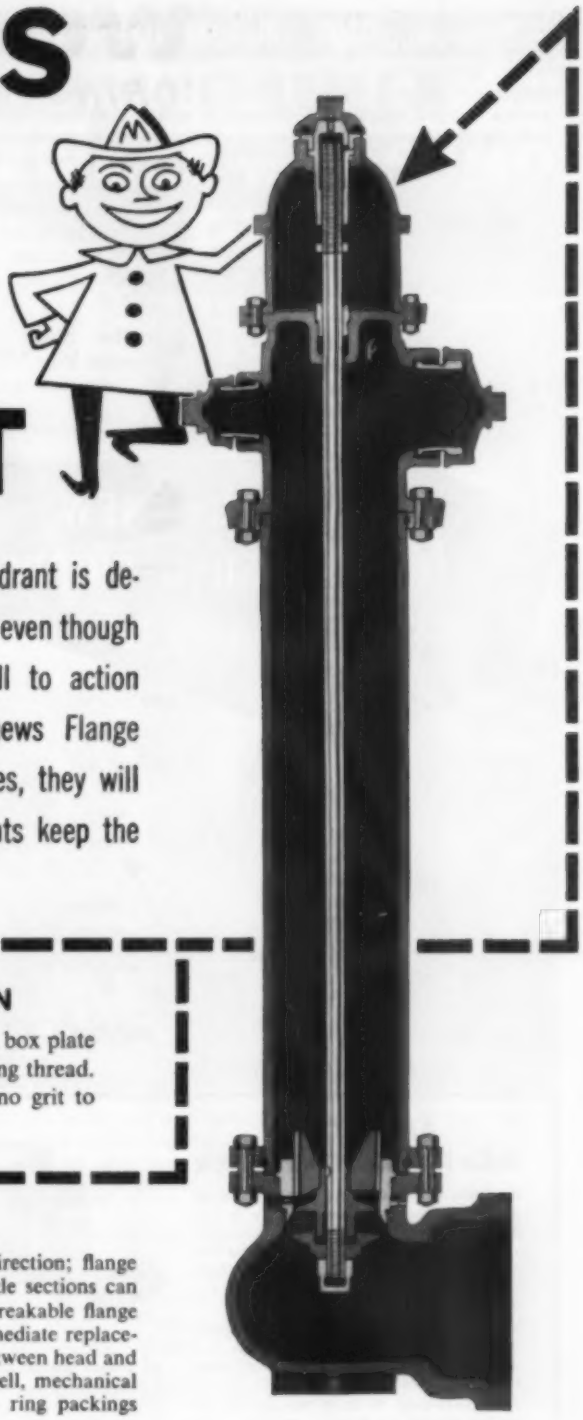
Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"The Highway Program: Today and Tomorrow." A panel discussion by five leading highway experts—J. A. Volpe, AGC President; Congressman G. H. Scherer of Ohio; Federal Highway Administrator B. D. Tallamy; A. E. Johnson, AASHO Executive Secretary; and State Senator R. Collier of California. (28½ min., sound, 16 mm.) Public Relations Department, Associated General Contractors of America, 1957 E. Street, N.W., Washington 6, D. C.

"Let's Look at Lightning." Review of some of the conditions causing lightning and solutions to various arrester application problems. (16 min., color, sound, 16 mm.) Line Material Industries, McGraw-Edison Company, Milwaukee, Wisconsin.

"Water - Wealth or Worry for America." A report on the water supply problem and the planning by water departments of progressive cities to assure prosperous growth of

MATHEWS FLANGE BARREL HYDRANT



The most important single feature of any hydrant is dependability. It must be operable when needed, even though it has remained idle for years and the call to action comes during a hard freeze. Install Mathews Flange Barrel Hydrants, and when emergency strikes, they will be ready to serve! These outstanding hydrants keep the neighborhood safe.

DRY HEAD CONSTRUCTION

Cast integral with the nozzle section, the stuffing box plate keeps water and sediment away from the operating thread. No ice to jam the thread in freezing weather; no grit to wear out the operating thread.

AND THESE FEATURES, TOO:

A swivel flange permits nozzles to be faced in any direction; flange barrel reduces accident costs because top cap and nozzle sections can usually be salvaged from broken hydrant • Optional breakable flange and stem coupling snaps in traffic accident, permits immediate replacement without excavating • Extension piece insertable between head and barrel or between barrel and elbow • Available with bell, mechanical joint or flange pipe connections; conventional or "O" ring packings

Conform to latest AWWA specifications

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers also of Mathews Modernized Hydrants, R. D. Wood Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

their communities. (14 min., color, sound, 16 mm.) Cast Iron Pipe Research Association in care of local branch of Modern Talking Picture Service, Inc., 3 East 54th St., New York 22, N. Y.

"All Around the Town." A pictorial record of the Austin-Western sweeper on all classes of city streets, with cross section animated drawings of its sweeping, carrying, dumping and flushing abilities. State highway, city and airport work are illustrated. (21 min., color, sound, 16 mm.) Austin-Western. Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Aurora, Illinois.

"Building the Magic Carpet." Describes the construction and engineering methods and procedures used in building a specific heavy-duty bituminous concrete highway project in Michigan. (28 min., color, sound, 16 mm.) National Bituminous Concrete Association, 1145 Nineteenth St., N.W., Washington 6, D. C.

"The Story of Irrigation and Transite Pipe." The various methods of irrigation as practiced in this country and the uses of Transite Pipe for the formation of the basic underground lines. (32 min., color, sound, 16 mm.) Johns-Manville Sales Corporation, 22 East 40th St., New York 16, N. Y.

"The Nature of Glass." The story of glass as a basic engineering material. (37 min., color.) Corning Glass Works in care of Association Films, Inc., 799 Stevenson St., San Francisco, Cal.

"HTH—For Water Fun and Safety." Describes proper chlorination practices and swimming pool maintenance techniques. (2 min., color, 16 mm.) Olin Mathieson Chemical Corporation, Baltimore 3, Maryland.

"Building a Highway." A sightseeing trip behind the scenes of the Interstate highway construction program showing aerial photographic survey, electronic computation, earthmoving and concrete paving equipment operation. (16 min., color, sound, 16 mm.) Portland Cement Association in care of local branch of Modern Talking Picture Service, Inc., 3 East 54th St., New York 22, N. Y.

"Day in Court." A dramatic presentation of a most effective method to encourage safer driving and the way in which hundreds of thousands of Los Angeles, California, citizens were enlisted in a crusade to save lives. (29 min., black and white, 16 mm.) International Harvester Company in care of local branch of Modern Talking Picture Service, Inc., 3 East 54th St., New York 22, N. Y.

"A Matter of Record." The story of tractor shovel applications for city, county and state public works programs. (20 min.) Clark Equipment Company, Construction Machinery Division, Benton Harbor, Michigan.

• • •

Tree Damage by Snow and a Tree Repair Program

A late September snow-storm in 1959, heavily damaged many of the 25,000 municipal trees in Canon City, Colo. For trimming, topping and removal, $25,000 was set aside in the 1960 budget. All available maintenance men were diverted to tree removal immediately following the storm, but a tree trimming firm was employed to work through 1960 repairing the storm damage. The contract price is $10 per hour each for two crews.

POWERFUL, NEW
M&M BRUSH CHIPPER
handles limbs up to
8" diameter

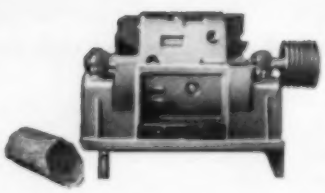
107

AMERICA'S
NO. 1 BRUSH CHIPPER

M & M's exclusive design of small, staggered and tapered cutting knives in the large cylinder allows chips to be shaved off . . . not cut off; makes it possible for this new chipper to handle 8 inch logs without creating impact shock responsible for damaging bearing and clutch wear.

Unique twin-bar design allows the chipper to produce either large or small chips . . . a profit-making feature, since small chips have many uses.

The heavy-duty M & M chipper has a built-in blower to regulate direction and distance of chips. Large, heavy rotating cylinder in between heavy-duty roller bearings eliminates overhanging flywheel. All-welded, special alloy steel construction



of simple design assures trouble-free operation and low maintenance costs.

With the addition of this heavy-duty model, Mitts & Merrill manufactures a complete line of chippers in sizes and capacities for any brush disposal requirement. Write today for complete information.

LARGE AND SMALL M&M HANDLES THEM ALL!

MITTS & MERRILL • 1005 So. Water Street • SAGINAW, MICHIGAN

BUILDERS OF WORK-SAVING, MONEY-SAVING AND MATERIAL RECLAIMING MACHINERY SINCE 1854

WATER POLLUTION BY SHIPS

We have read with considerable interest the editorial "Sewage Treatment to Prevent Water Pollution by Ships" appearing in the August, 1960, issue of PUBLIC WORKS. This editorial is very timely. Interest in this subject is being indicated by industry, Federal, State and foreign governments.

As you know, there has been increasing interest during the past several years relating to the pollution from vessels operating on the Great Lakes. The opening of the St. Lawrence Seaway for entry of United States and foreign flag vessels into the Great Lakes has focused attention on this subject.

The Surgeon General, by authority of the Interstate Quarantine Regulations, has designated delimited areas around all domestic water intakes in the Great Lakes in which the discharge of sewage and waste from vessels is prohibited. In general, these areas are defined as a circle of three-mile radius and having the water intake as its center. The several State health departments have cooperated with the Service in establishing these areas. This delimiting action and areas will soon be published in the Federal Register.

The General Engineering Program, Division of Engineering Services has assigned personnel to Region V, Chicago, to conduct a study project relating to vessel operations on the Great Lakes. This project will include: 1) Protection of vessel water supplies; 2) discharge of wastes from vessels; 3) delimiting areas around waterworks intakes; 4) discharge of garbage; 5) port sanitation; and 6) harbor sanitation.

In addition to this, the Service has established an inter-agency Committee on Sewage and Waste Disposal from Vessels. The Maritime Administration; Corps of Engineers; Navy Bureau of Medicine and Surgery and Bureau of Ships; Surgeon

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Economical
LIFT
STATIONS

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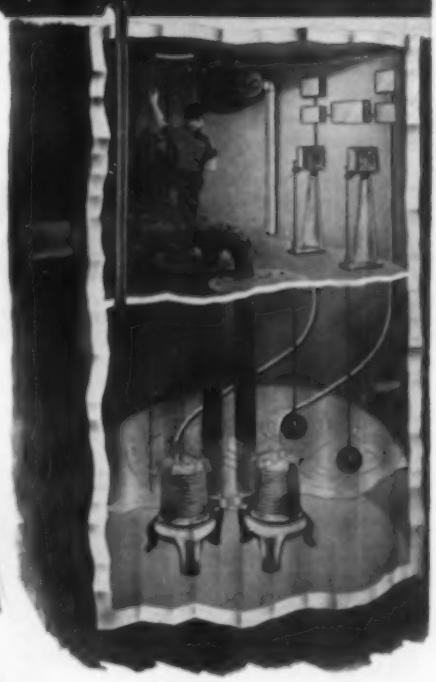
Low Maintenance Cost



FEATURES

A true NON-CLOG impeller, most efficient design for handling rags, stringy material and irregular solids with the liquids. 5" pumps will pass 4" solids.

Send for Bulletin SE-860
See weil catalog in Sweet's and Domestic Eng. Cat. Dir.

The weil Submersible NON-CLOG Sewage and Sump Pump has proven in thousands of installations that it operates efficiently and economically completely submerged under water. Depth of settings offer no problem; the only requirement is in selecting the proper unit with sufficient head to pump out of the sump. The pump is the same compact close coupled unit regardless of the depth of the pit.

Low Installation and Low Operating Cost

Economy and simplicity of installation – only one piping connection required – and very low maintenance due to the hermetically sealed motor, assure a low initial cost and years of trouble-free operation. No expensive pump house is required to mar the landscape.

Wide Range to Select From

The Submersible Ejector is available in discharges of 3", 4", 5" and 6" with heads to 60 feet and capacities to 2000 GPM. Motors of 1750 RPM or the new long-life slow speed 1150 RPM available for all units. Wide variety of controls available to fit special requirements.

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General of the Army; Coast Guard; Department of Agriculture; and Divisions of Foreign Quarantine, Water Supply and Pollution Control and Engineering Services of the Public Health Service, are represented on this Committee. The major objective will be to establish criteria for the disposal of sewage and waste from vessels operating in the Great Lakes, inland and coastal waters within the jurisdiction of the United States.

We thought this information would be of interest to you. Should you wish a more detailed account of our activity in this area, please let us know.

George L. Carley, Jr.
Acting Chief
General Engineering Program
Division of Engineering Services
Public Health Service

• • •

Cost of Meter Repairs

The Water Department of Seattle, Wash., reports that, for 1959, the direct cost of meter repairs was: For ½-in. meters, $3.37; for ¾-in., $4.34; for 1-in., $3.43; for 1½-in, $6.20; for 2-in., $10.89; and for 3-in., $14.20.

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A TYPE FOR EVERY SERVICE
RUGGED — DEPENDABLE
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SEWAGE PUMPS

DRY PIT - WET PIT
SUBMERSIBLE
HORIZONTAL
CHOICE OF IMPELLERS

NON-CLOG DRY PIT pump with double suction elbow and stand. Send for Bulletin 1850.5.

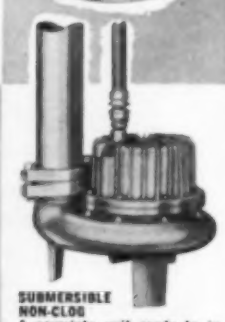
NON-CLOG WET PIT with cover. Single unit. Duplex models with alternating controls available. Send for Bulletin 1850.2.

PACIFIC NON-CLOG PUMP with motor, motor support bracket, suction elbow and stand. Send for Bulletin 1850.5.

HORIZONTAL NON-CLOG MODEL with flexible coupling. Send for Bulletin 1850.5.

Outstanding performance and long trouble-free service from every type. Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.

Order now. ALL TYPES AVAILABLE FOR IMMEDIATE SHIPMENT.



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A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.5.

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NEWS OF ENGINEERS

NORMAN D. KURTZ has been appointed administrative assistant to Fred S. Dubin and Associates, consulting engineers of Hartford, Conn., New York, Boston, St. Louis, San Juan, P. R., and the Virgin Islands.

THOMAS DEF. ROGERS, Brigadier General, Corps of Engineers, succeeds COL. HARRY O. FISCHER, in command of the North Central Division, Corps of Engineers. Col. Fischer becomes chief of staff for the Engineer Center at Fort Belvoir, Va.

L. K. CRAWFORD, consulting civil engineer of Springfield, Ill., and RALPH M. WESTCOTT, consulting mechanical engineer of Los Angeles, have been appointed to national committees of the U. S. Chamber of Commerce.

DON P. REYNOLDS has been named Assistant Secretary of the American Society of Civil Engineers succeeding E. L. CHANDLER who has retired. E. STUART KIRKPATRICK has been appointed executive assistant.

W. S. BAVER, long-time sanitary engineer, and since 1931 with the City of Newark, N. J., died July 16. Since 1947, he had been engineer in charge of sewers. He was a life member of ASCE and a licensed professional engineer.

ARTHUR B. GALLION, formerly of the University of Southern California, has been appointed director of planning for the Honolulu Office of Harland Bartholomew & Associates of St. Louis.

DR. MYRTON C. RAND has joined the faculty of the Civil Engineering Department of Syracuse University as Associate Professor in the graduate and research programs in Sanitary Engineering. Recently Dr. Rand was Chief Chemist of the Middlesex County Sewerage Authority in New Jersey.

GEORGE W. HAMLIN, former water commissioner of Cleveland, O., died Aug. 5. During his 45 years with that city, he had a significant part in the construction of all four Cleveland water treatment plants. He served as field engineer, design engineer, construction engineer and acting commissioner of Public Utilities, in addition to his assignment as Water Commissioner.

Flood Flows in Alabama Streams

A study by the U. S. Geological Survey and the Alabama Water Improvement Commission on low-flow and flow-duration data for Alabama streams includes for a number of streams the discharges equalled or exceeded one percent of the time. The study covers the 17 years from 1940 through 1956. The data are presented here by watershed areas.

Areas Less Than 100 Sq. Miles

Of the watersheds reported on 17 had areas less than 100 sq. miles. Aside from the two smallest, 22.8 and 24.2 sq. mi., neither of which reported flows in excess of 10 cfs/sm, the water sheds were mostly in the 80 to 100 sq. mi. group (11 of the 17). The highest flows, 19.6 cfs/sm were reported by Yellowleaf Creek (97.2 sq. mi.) and Short Creek (91.6 sq. mi). Following, in order of runoff were West Fork of Flint Creek, 87.6 sq. mi., with 17.2 cfs/sm; Weogufka Creek, 73.6 sq. mi., with 16.0 cfs/sm; and Flint Creek, 86.3 sq. mi., with 15.1 cfs/sm. The median discharge was 12.2 cfs/sm. The lowest was Kinterbush Creek, 91.4 sq. mi. with a discharge of 4.5 cfs/sm.

100 to 150 Sq. Mi.

There were 16 watersheds reported on with areas from 100 to 150 sq. mi., quite evenly spaced in distribution over the range of areas. The highest flows were from Lost Creek, 130 sq. mi., which reported a flow of 2700 cfs or 20.8 cfs/sm. Other relatively high flow areas included Little River, 120 sq. mi., 19.1 cfs/sm; Chickasaw Ck., 123 sq. mi., 17.1 cfs/sm; and Talladega Ck., 148 sq. mi., 16.9 cfs/sm. The median was 15.4 cfs/sm and the low 5.4 cfs/sm from Tuckabum Ck., which had a drainage area of 112 sq. mi.

150 to 300 Sq. Miles

Flows were reported for 27 streams having drainage areas of 150 to 300 sq. miles. The highest flow exceeded one percent of the time was 23.4 cfs/sm on Kelly Creek which has a watershed area of 192 sq. mi.; the next two high flows were 23.0 cfs/sm from Cedar Creek, 217 sq. mi., and 20.4 cfs/sm from Big Nance Creek with 166 sq. miles of drainage. The median of the 27 watersheds was 14.7 cfs/sm and lowest, from Murder Creek, 170 sq. mi., was 9.4 cfs/sm.

Comment

These data represent the flows equalled or exceeded one percent of the time for the 17-year period previously indicated and therefore

(*Continued on page 206*)

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WHATEVER... The Spread—Chlorides or Chips

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WHEREVER... The Job—Town or Country

Flink HDWS4 Completely Hydraulic Tailgate Spreader—A fleet of these efficient rigs help keep traffic rolling on the Illinois Tollway! Left-rear spinner permits easy 2-3 lane spreads in one pass; saves material. Hydraulically operated, cab-controlled, 2-speed auger permits instant change from abrasives to straight rock salt. Volume controlled by hydraulically operated feedgate.

Flink LMC Hopper Spreader—Handles salt, cinders and sand for heavy-duty ice control. Pea gravel and chips for seal coating. Choice of PTO, hydraulic or gasoline engine drive, cab-controlled. Uses the only power transmission of its kind in the field. No worm gears, no "out-of-straight" shafts of U-joints. Differential equalized drive.

Flink HD42 Hydraulic Drive Tailgate Spreader—Consistently picked by smaller communities that need *both* faster ice control and seal coating in the *same* low-cost rig! Self-feeding. Handles all Chlorides and abrasives. Spreads from width of truck to width of street, thick or thin. Replaces tailgate on present trucks. Trips for dumping just as original tailgate did.

BAKER Flink SNOW PLOWS

FOR FAST, LOW-COST SNOW REMOVAL!

Reversible or one-way plows for 1½ to 5 ton trucks and up. Sectional or one-piece, full-length cutting edge trip. Exclusive blade-hinge weldments in place of hinges cut maintenance. Full 3¼" wear on a 6" cutting edge. Operating position adjustable 65° or 75° from horizontal.

Our distributor-field engineers will gladly furnish you with full particulars; just write:

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MELT ICE FASTER!

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Mix one part Dow calcium chloride with two or more parts rock salt . . . and you combine the best features of both. Calcium chloride dissolves first . . . penetrates ice immediately, at all temperatures. This *activates* slower-acting rock salt, accelerates its melting action. Two Dow calcium chloride forms, pellet or flake, meet all your ice-control needs. Write for brochure—"Calcium Chloride and Salt Mixtures."

DOW

THE DOW CHEMICAL COMPANY

Midland, Michigan

Municipal Power

EFFECTIVE GROUNDING OF ELECTRIC SYSTEM NEUTRALS

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Co.
Kansas City, Missouri

A PROBLEM frequently encountered in the expansion of municipal electric distribution systems is the determination of the proper method, or methods, to effectively ground the neutral of electric system power circuits, to permit three phase four wire distribution from power plant and substation buses.

Obviously, single phase line to neutral loads cannot be applied to three phase, three wire delta connected circuits, since there is no electrical neutral point to carry unbalanced currents back to the phase conductors. Similarly, an ineffectively grounded neutral three phase circuit cannot be used for single phase line to neutral loads because of the danger of high transient line to neutral voltages on the two unfaulted phases during a line to ground fault on the third phase.

As an illustrative example of this problem, let it be assumed that an existing municipal power plant bus is being operated at 2400 volts three phase delta, and that it is planned to increase the plant's generating capacity and to establish a new bus for three phase four wire distribution at 2400/4160 volts wye (or 7,620/13,200 volts wye). In this case, two methods are indicated for establishing a solid, effective neutral ground for the new bus. The first method would be to provide a bus tie transformer to connect the old and the new buses, with the transformer connected delta on the 2400 volt side and connected solidly-grounded wye on the 4160 volt side. Such a wye-delta transformer bank provides an ideal neutral grounding method. Any power flowing to the 4160 volt bus from the existing generators connected to the 2400 volt bus, must flow through the transformer, which provides a zero sequence to positive sequence reactance ratio of 1.0, with little, if any, overvoltage on unfaulted phases during line to ground faults.

This condition would hold so long as the new generator on the 4160 volt bus was shut down. If this generator were to be operated ungrounded, to help supply the load on the 4160 volt bus in parallel with the power fed in through the bus tie transformer, then the positive sequence system reactance would decrease, the zero sequence reactance would remain the same, and the ratio of zero to positive sequence reactance would increase.

If this ratio were to increase to 1.5 transient overvoltages of 7½ percent above normal might be expected during line to ground faults on feeders emanating from the 4160 volt bus. If the ratio were to increase to more than 3.0, then transient overvoltages of 25 to 30 percent or more above normal would be experienced (leading to damaged distribution equipment and consumer utilization apparatus), and "grounded- neutral" rated lightning arresters might flash over with power arc follow-through currents, and become destroyed.

To prevent this possibility, and to provide an effective system neutral ground at times when the bus tie transformer might be disconnected, it would be necessary to ground the neutral of the new generator connected to the 4160 volt bus.

Inherently, three phase generators exhibit a lower zero sequence reactance than positive sequence reactance. Therefore, if a wye connected generator neutral were connected solidly to ground, the zero sequence reactance might be only 3 percent more or less, while the subtransient positive sequence reactance might be as high as 10 percent, assuming a 3600 rpm two pole generator.

If solidly grounded, the generator would not produce transient overvoltages under line to ground fault currents; however, the line to

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ground fault currents would exceed the minimal three phase short circuit currents by approximately 30 percent, resulting in excessive stress and possible damage to the generator coils and system equipment.

To limit line to ground fault currents to three phase fault values, a neutral reactor should be connected between the generator neutral and the station ground bus. If the subtransient and negative sequence reactance of the generator is 10 percent, and the zero reactance is 3 percent then the desired external neutral reactance would be 2.33 percent on the generator KVA base.

As a further example, let it be assumed that an existing 13.2 KV three phase delta connected substation bus is to be effectively grounded to permit the use of three phase four wire grounded neutral distribution feeders and loads.

In such cases, the method for establishing a stable electric system neutral is to provide a grounded wye connected three phase zig-zag transformer or a grounded wye three phase wye-delta transformer bank. Such transformers are generally sized to carry line to ground fault currents for 10 seconds (where relays are arranged to automatically protect the grounding equipment) or for 1 minute (where back-up ground relaying sounds an alarm, only, for equipment protective operations by the system operator).

The selection of either a three phase zig-zag grounding transformer or a wye-delta grounding transformer bank, to establish the neutral on a three phase, three wire delta connected bus, is a matter of economics. Generally speaking, smaller banks are of the wye-delta transformer type while larger grounding transformers are of the zig-zag type.

• • •

Conference on Disinfection and Oxidation

The Third Sanitary Engineering Conference sponsored by the University of Illinois Civil Engineering Department and the Sanitary Engineering Division of the Illinois Health Departments will be concerned with disinfection and chemical oxidation of water and wastes. It is scheduled for January 31 to February 1, 1961 at Urbana, Ill. Further information may be obtained from Ben B. Ewing, Associate Professor of Sanitary Engineering, University of Illinois, Urbana, Ill., or from C. W. Klassen, Chief Sanitary Engineer, Department of Public Health, Springfield, Ill.

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VERMEER POW-R-DITCHER

From whatever angle you look at it, you'll recognize the big, powerful ditcher that can solve most of your trenching and ditching problems . . . the model 524T Vermeer POW-R-DITCHER. Unit above is digging water main ditch on a large construction project at Lexington, Ky. Ruggedly built to handle the toughest jobs, the POW-R-DITCHER is ideal for municipalities, contractors, utility companies and institutions.

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The Self-Propelled POW-R-DITCHER digs at variable speeds, 8 to 24 inches wide and down to 6 feet deep. The 524T POW-R-DITCHER is a one-man operated, highly maneuverable unit. Large two-way conveyor deposits dirt on either side of ditch. Has hydraulically controlled steering with separate steering lever for each crawler track. Especially designed for digging wide foundation footings, gas, water and sewage lines. Low in price . . . low in maintenance cost.

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ELECTRONIC COMPUTERS TACKLE TOLL TABULATION

NEVILLE R. ASHCROFT
Comptroller
The New Jersey Turnpike Authority,
New Brunswick, New Jersey

OUR experience at the New Jersey Turnpike Authority, with various types of data processing equipment might be said to constitute a classic case history. Since the opening of this 130-mile superhighway in 1952, the punched cards that serve as our toll tickets have been the basis for all of our toll revenue accounting and statistical data processing. In 1956 we installed two Remington Rand Univac 60 punched-card electronic computers to supplement our conventional equipment. As the volume of traffic continued to grow—it has more than tripled since the road was opened to a present annual total of more than 46,000,000 vehicles—we added two more computers of the same kind to handle the increased workload.

Several months ago, after a long period of intensive study, we replaced all four with a single, compact new system which is now in full operation — the Univac Solid-State Computer. We are the first toll highway in the nation, and the fourth business organization of any kind, to take delivery of the new equipment.

The development of our present data automation program, therefore, has been a step-by-step procedure that has historically coincided with the development and improvement of computers themselves. In the process, we have picked up a good deal of first-hand knowledge about the relationship between computers and profitability — perhaps not enough to qualify as experts, but certainly enough to offer some sound general advice on how to get the most out of an investment in office automation.

One of the first rules-of-thumb we would establish, for anyone contemplating a switch to automatic clerical methods, is a simple way of deciding in which areas of work the change is warranted. If a given piece of paper is used more than three and a half times during the course of its life as an active document, its translation into punched-card form is justified. Papers used less often than that are apt to be more economically handled by conventional manual methods, and the wholesale inclusion of such data in an automation program may well create an unnecessary financial burden by robbing the equipment of time that could more profitably be spent elsewhere.

Another cautionary note: In the beginning of any computer project, it is generally inadvisable to assign a variety of different applications to the equipment right away. Ideally, there should be one primary application, one bread-and-butter job that clearly warrants the computer's service and that uses close to half its available operating time. This application should be thoroughly checked out and working before other chores are assigned to it. Once the computer has thus been economically justified, whatever machine time remains can be devoted to more "sophisticated," less immediately profitable tasks.

In our case, the bread-and-butter job has been the toll audit application—the exhaustive daily accounting process by which the punched cards, collected from motorists at the interchanges, are digested and totalled into various operating reports. This originally took 60 percent of our total machine time and more than justified the cost of the equipment. We could thus well afford to spend the remaining 40 percent on maintenance cost accounting, traffic density studies and other applications.

No single requirement for any successful computer installation is more important than that of competent, well-trained personnel. No computer will ever be better than the people who run it or do the necessary programming. In the early stages of any computer project, preferably as long as possible before the equipment is actually installed, a formal training program should be well under way among clerical and technical personnel. Nor should management's concern with the training program diminish once the data processing center is a going

● **PROCESSING center of N. J. Turnpike uses computer to process toll charges for the 42 million vehicles which use the turnpike annually and for other purposes also.**

Q: "Why don't they use a heavier-gage pipe?"

A: "Don't need to. They take advantage of Beth-Cu-Loy sheet steel's flexibility."

Drainage pipe made of Beth-Cu-Loy corrugated sheet steel does look light enough to crumple beneath the weight of passing traffic. Fact is, though, that its very thinness is the key to Beth-Cu-Loy's success in drainage structures.

Load distributed around pipe

In short, a Beth-Cu-Loy pipe has transverse flexibility which enables the pipe to enlist the aid of the surrounding material to support imposed loads. Instead of the pressure being exerted solely through the vertical axis of the pipe, it moves into, and compacts, the trench walls. In this way, the load is evenly distributed around the periphery of the pipe.

Drainage pipe made of Beth-Cu-Loy sheets is strong because it's *steel;* durable, because it has a heavy coating of corrosion-resisting zinc. It is light enough for easy installation, and flexible enough to conform to variations in grade and alignment. It conforms in every way to the specs of the AASHO.

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If you would like full details about Beth-Cu-Loy sheets for drainage structures, you will find just about everything you need in our 80-page Booklet 425-B, "Solving Drainage Problems." Ask your pipe fabricator for a free copy, or write direct to us.

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. . . economy
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BLACKBURN-SMITH PNEUMATIC

SEWAGE EJECTORS

Preferred by Engineers

More sanitary, cleaner and less messy.

No complicated piping.

No place for collection of solids within pots.

Minimum maintenance.

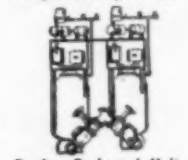
●

Dependability. Installed in New York City Subway System.

●

20 to 1,000 gpm single and twin units. Discharge heads to 150 ft. or more.

Single Packaged Unit



Duplex Packaged Unit

Duplex Ejector

The Blackburn-Smith Pneumatic Ejector System, with or without air receivers, offers the following controls:

ECT—Elecrode Control Type — EXT—Electrode Control with inlet-outlet connection at top. — FST—Float Switch Type — SFT—Side Float Type RFT—Rising Float Type—BFT—Bell Float Type.

Used in hundreds of sewage booster stations. For over 60 years, Blackburn-Smith Ejectors have proved their economy, efficiency, and reliability.

Send For Booklet S-55

BLACKBURN-SMITH MFG. CO.

61 Garden St., Hoboken, N.J.

OLdfield 9-4425 N.Y. Phone: BArclay 7-0600

Blackburn-Smith Can Also Supply:

FEEDWATER FILTER AND GREASE EXTRACTOR

Eliminates oil, grease, dirt, fine matter from feed water. Used by world's largest industrials; U.S. Government: Municipalities: Marine field. Single & Twin type.

ROTARY STRAINER

Strains solids from water, oil, other liquids. Easy and infrequent cleaning, without flow interruption. Simple; compact; strong; trouble-free.

AUTOMATIC STRAINER

Gives continuous self-cleaning service on water lines, or lines carrying processing liquids, oils, etc. Rugged. Dependable. Economical.

PLUG TYPE DUPLEX STRAINER

Serves both as a Strainer and a Filter for liquids or gas. Strainer and Filter elements interchangeable. Special designs available.

OIL REFINER

Outstanding achievement in pressure leaf filters. Extremely fine filtration. Removes emulsified and free oil from condensate down to .01 parts per million.

● ***Send For Latest Bulletins*** ●

concern. Important new developments in the computer field, both in applications and in the equipment itself, are occurring all the time, and it is very much to the advantage of top management to make sure that its employees are kept abreast of them. The major computer manufacturers are eager to cooperate in this effort. The continuing program of training courses and seminars they offer provide invaluable assistance.

No sooner had we installed and programmed our first Univac 60 computers, for example, than our key personnel began formally acquainting themselves with the working of the Univac File-Computer, a versatile medium-sized system which then seemed the most likely choice for eventual installation as soon as the volume of traffic increased enough to warrant its expense. For the next two years, while augmenting our existing installation with the two additional Univac 60's, we continued to keep our sights trained on the File-Computer. Our personnel were fully qualified to program and run the larger system the minute its installation was indicated.

What happened instead was the sudden emergence of the Univac Solid-State system, which was more suited to the specific kind of work we have to do. This computer occupies only 575 square feet of floor space, yet its speed and capacity have made it possible for us to accomplish in 60 percent of machine time, the same amount of work that formerly required 98 percent of the total capacity of the four earlier units. Moreover, owing to the fact that our technical people had so long been thinking in medium-sized computer terms, we were able to get the new system in full operation very soon after the hardware was delivered.

Today, we estimate that the solid-state system is paying for itself as long as annual traffic volume on the turnpike exceeds 42,000,000 vehicles —four million less than last year's actual count. In addition to the obvious financial advantages, there is the fact that we will now be able to explore new realms of statistical analysis and administrative control. The improvement in speed and capacity over our previous computer has already been demonstrated.

Even if Turnpike traffic continues to grow at its present phenomenal rate, we will be able to handle it comfortably with our present equipment for at least five, and possibly as many as ten years to come. By

TWO PIECE
sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.
Adjustable
VALVE BOXES
THREE PIECE
valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Complete line of service and roadway boxes.
ALABAMA PIPE CO.
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Faster LOCATING!
LOWER SERVICE COSTS
with the improved AQUA VALVE BOX LOCATOR!
$32.50 F.O.B. Ohio
Your Name In Gold FREE!
STOCK this useful tool for every service CAR and CALL •
Speed Locating • Keep Customers Happy
• NO WIRES, BATTERIES or SWITCHES—simple, powerful magnetic action, factory adjusted to YOUR geographical location assures unfailing results!
• NO NEEDLE SPINNING—exclusive electric braking action saves you time!
• NO STOOPING—easy top-view reading!
• RUGGED—compact, accurate, convenient!
• GUARANTEED—to function regardless of weather, surface or ground cover!
• NATION'S MOST WIDELY USED LOCATOR!
• 15-DAY FREE TRIAL—No money! No obligation! You be the judge!
ORDER NOW - Wire or Call
VAlley 1-2514 collect
AQUA SURVEY & INSTRUMENT CO.
7041-B Vine Street, Cincinnati 16, Ohio

then, however, and possibly much sooner, there will undoubtedly be still newer developments in computer technology that may warrant further changes in our installation. The significant fact is that we are now prepared to take the fullest possible advantage of whatever the future holds.

Getting the most out of computers is a job requiring the constant application of common sense, foresight, and the ability to encompass new ideas. On the basis of our experience, we can testify that the reward are gratifying.

• • •

Contracts With Consultants

(*Continued from page* 117)

Section 1 includes definitions of words, terms and other items upon which emphasis has been placed. The value of identical interpretation is of such importance in subsequent sections, as well as in the contract document and related correspondence, that the definitions are italicized in the remaining contents of the Specifications for the purpose of critical and comprehensive reference.

For example, what is the joint understanding of the terms: "Addition or Deletion" vs "Change." Ohio's Specifications set forth the following distinctions: ADDITION—"The jointing or uniting so as to increase the number, augment the quantity or enlarge the magnitude of the work." DELETION—"The removing or eliminating so as to decrease the number, diminish the quantity or reduce the magnitude of the work." CHANGE—"The substitution of one thing for another, the values of which are not necessarily equal."

Logically following in a closely related category of the specifications, and made a part of any engineering agreement or contract, are the following:

PAYMENT FOR ADDITIONS OR DELETIONS—"The State may, upon written notice and without invalidating the Engineering Agreement, require any Additions to or Deletions from the originally contemplated extent of the work. All adjustments of this nature shall be executed under the applicable fee as set forth in the Engineering Agreement, based on the adjusted quantity of Work; except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such Addition or Deletion."

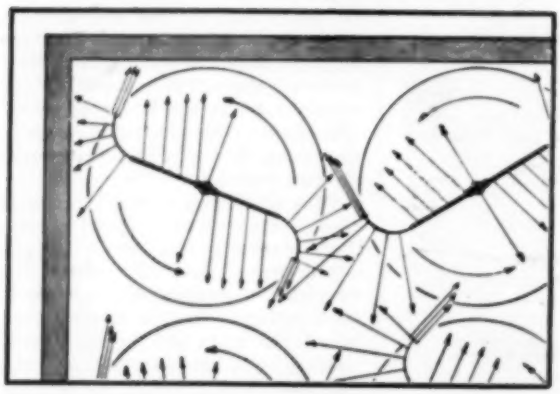
CHANGES REQUIRING ADDITIONAL-FEE PAYMENTS — "The State may, upon written notice and without invalidating the Engineering Agreement, require Changes resulting in the revision or abandonment of work already satisfactorily performed by the Consultant.

"The value of such Changes, to the extent not reflected in other payments to the Consultant, shall be determined by mutual agreement in one or more of the following ways: a) By estimate and acceptance in a lump sum; b) by unit prices identified in the Engineering Agreement or upon which there is subsequent agreement; and c) by cost plus one hundred (100) percent, or by cost and a fixed fee.

"The cost in (c) supra is defined as the actual productive salaries of all personnel, including partners or other officers of the Consultant who are directly engaged in the work involved as evidenced by transcript copies of payrolls and an affidavit. Fringe benefits, non-productive payroll expenditures, travel and subsistence, overhead, etc., shall be included in the percentage or a fixed fee.

"However, no Changes for which Additional-Fee Payment is claimed shall be made unless in pursuance of a written order from the State,

NOW! A 25% to 30% further increase in filter cleaning efficiency



New S-Type Filter Arms double the cleaning action

With new S-Type arm of Agitator shown above each corner and void area receives four (4) agitating impulses per revolution instead of two . . . doubling the cleaning action in those areas. S-Type Arms can also be adapted to older units in service. Ask us for full particulars.

(*Patent Pending*)

Palmer Filter Equipment Co. 822 E. 8th St. Erie, Penn.

THE ANSWER TO ALL COMPACTION PROBLEMS

WACKER CORPORATION HARTFORD, WISCONSIN

The WACKER GVR 100-C Rammer removes any doubt about compactability. Up to 100% Proctor Density Tests prove it is the best compactor on the market, pound for pound of machine weight. Try it!

WRITE FOR FREE LITERATURE

Gentlemen: PW-10
Please send me free descriptive literature and the name of your nearest dealer.
Name .....
Address .....
City ..... Zone .... State .....

WACKER

PRESSURE CONTROLS FOR ALL YOUR NEEDS

Healy-Ruff Company offers a complete line of easy-to-install, simple-to-use pressure-sensing controls for water works and sewage fields. Control only, or indicating and recording as well, can be supplied. All systems incorporate these desirable features:

- *Ball bearing rotation and springless mechanism—measures pressure to ½% of operating range*
- *Field adjustable time delays, provided where necessary to prevent start and stop surges from cycling the pumps*
- *Independent high and low pressure adjustments*
- *Minimum differential between start and stop points*

THE R-4 ROTOTROL permits controlling high and low elevation of water in an elevated tank, stand pipe, or reservoir. Automatically compensates for pumping friction. Closed system and booster system controls also available. *Bulletin R-4*

THE PW ROTOTROL controls both pressure and water level in hydropneumatic tanks. Cuts off pumps on either high pressure or high level Air-add or air-release types. *Bulletin PW-6*

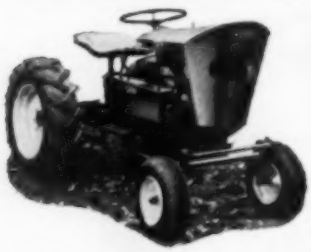
THE RPS ROTOTROL controls level in pumping stations, sewage plants or reservoirs. Senses level change through corresponding change of pressure in compression bell submerged in wet well. Purged air or compression pipe types. *Bulletins RPS and RS3*

HEALY-RUFF COMPANY

791 Hampden Avenue • St. Paul 14, Minn.

First in dependable controls for waterworks and sewage—since 1929

Remote supervisory controls • Complete system controls • Elevated tank controls • Sump controls • Hydropneumatic tank controls • Float controls • Alternators • Alarm silencers • Protective devices



Model S-23
9 h.p. $475. list

SPEEDEX

PLOWS SNOW *"like a fool!"*

Heavy-duty 40" snow blade is ideal for moving snow from SIDEWALKS, DRIVES, PARKING AREAS, etc. Will also do light grading, dirt and sanitary land fill pushing. Tractor useful year 'round with many guaranteed attachments.

SPEEDEX Model S-23 shown compares favorably in power and performance with nationally known farm tractors—at half the price! Look at these features:

- *Briggs & Stratton 9 h.p. engine*
- *2 power ranges*
- *½ to 10 m.p.h.*
- *Geared reduction steering wheel*
- *7" x 16" tires*
- *Easy-lift tool lever*
- *TIMKEN bearing transmission*
- *Wide selection of "UNIT-DESIGN" tools, all priced below average costs.*
- *Unusual stability and rugged construction*

MANY YEARS OF TROUBLE-FREE SERVICE

This latest SPEEDEX is an improved model of the famous tractors that have given such outstanding service for over 20 years. Our files are full of user letters telling of complete absence of breakage troubles—some haven't even had to replace a belt in 20 years! There's good reason—every SPEEDEX tractor is BUILT TO LAST—every part made far stronger than it will ever need to be.

CHOOSE FROM 5 MOWERS: Sickle-bar mowers, 30" x 42" widths; 4½ h.p. self-powered rotary mowers, 36" and 44" widths; 30" reel-mower, front mounted; three-gang mower (2 models); and underneath-tractor rotary mowers, 32" and 44".

Try a SPEEDEX Tractor this year—give it the most severe tests your work can require. It will prove itself and convince you that a SPEEDEX fleet investment is a wise and thrifty decision. Color folder gives all the facts. Write for it today. Dealer inquiries invited.

SPEEDEX TRACTOR CO. 377 No. Freedom, Ravenna, Ohio

and no claim shall be valid unless so ordered."

The connotations and ramifications of these contract terms and associated obligations, and their impact upon the consultant's take-home-pay, are the subject of much controversy. Much has been written about the development of charts and curves to reflect a consultant's proper fee for jobs when the fees are correlated or based upon some form of cost estimate including, perhaps, the actual bid price (most generally exclusive of construction change orders). However, if the owner decides to make some "Addition" to or "Deletion" from the magnitude of the work, there is no usual reason for a consultant to have the opportunity to renegotiate his fee for any reasonable increase or decrease in the number of units in the routine product. Conversely, if there were no other alternative condition, such as a legal understanding of "Change," the consultant might well consume any reasonable profit in his attempts to satisfy the vacillating and capricious struggles of the owner to come up with an end-product which is neither initially established in his mind nor set forth in his instructions and specifications to the consultant.

Section 2, which pertains to contract relationships between the owner and a consultant, sets forth the general clauses and convenants which are legally and functionally important.

To focus upon an element which often is considered of nuisance value, the preparation and maintenance of a Work Schedule and Progress Report have more ramifications than often is apparent. Ohio has taken the opportunity, in the non-contractual appendages to its specifications document, to counsel all contractual parties, as follows:

"The philosophies and mechanics of analyzing, scheduling and reporting proposed and actual work achievement, especially where the provision of professional services is predominate, are matters upon which the State and the Consultant must parallel interpretations if the progress reports are to be of optimum value. It is towards this end that the following comments are directed.

"First, the Engineering Agreement identifies the type and magnitude of the work very carefully prior to the submission (by the consultant) of his proposal. Experience has proved to him that certain approximate numbers of hours, of various categories of endeavor, are necessary

to achieve completion in each fundamental element of his responsibility. Such basic estimate work-sheets are vital to the preparation and maintenance of Work Schedule and Progress Reports as required in section 2.12 of his Engineering Agreement.

"Second, the Consultant is aware of the various categories of personnel available for full or part-time application to the manhours required to bring each element of work to completion. The simple division of productive hours available into the total hours required will result in the time period over which the efforts must be applied, with appropriate allowances of time for non-productive periods. This procedure, in the case of bar-chart representation, determines the length of each schedule bar or the total time period required for each element of work reported. Schedule bars can then be correlated with each other on the chart, allowing for the fact that certain elements cannot be initiated or progress substantially until some other element or elements have achieved a required degree of completion. Rates and degrees of achievement, in each work element, can then be adjusted between their termini of starting and completion dates. For example, if a certain element must be 30 percent complete before another time-consuming element can be initiated, and the Consultant's work sheets indicate that certain numbers of various categories of manhours are involved in the 30 percent achievement, he can then assign the necessary personnel to expedite that particular element and realize the objective which will then permit initiation of work on other contingent elements. This example illustrates that, although a particular element may require six months for total completion, it may be necessary to schedule and achieve 30 percent completion at the end of the first month.

"Third, as the report period closes and the actual progress requires determination, the Consultant can readily check his personnel time sheets which will reveal the number of hours applied to each work element as opposed to the total requirement. The resulting percentages, adjusted as may be necessary for certain less-tangible factors, become the estimated percentage of actual progress."

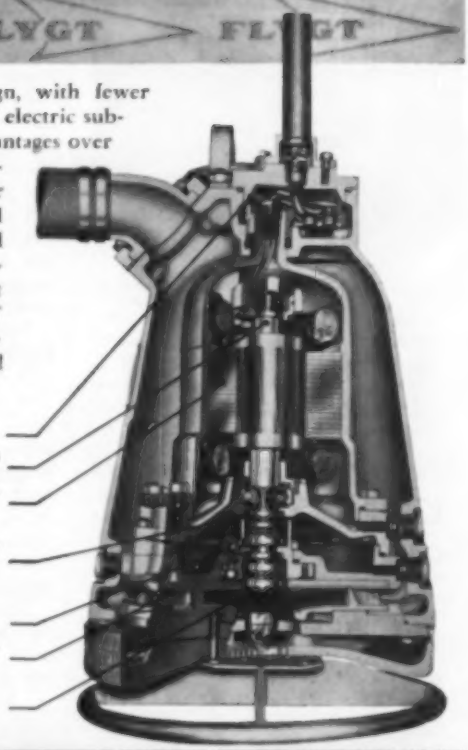
A correlated item in Section 2 is the matter of transfer of interest or sub-letting. Substandard performance of only one "Sub" may cause a

(*Please turn to page* 212)

FLYGT FLYGT FLYGT

THE INSIDE STORY OF FLYGT SUCCESS

Simple, revolutionary design, with fewer parts involved, gives FLYGT electric submersible pumps definite advantages over ordinary pumps. This internal simplicity produces higher pumping capacity at costs well below conventional units. All cast parts are a special aluminum alloy; impellers to suit each application. Let FLYGT prove itself — ask for an on-the-job demonstration today!



1. Junction box
2. Shaft, journalled in SKF bearings
3. Electric motor, watertight enclosure, running in air
4. FLYGT mechanical seals for heavy-duty
5. Oil for cooling and lubrication
6. Rubber-lined, replaceable diffusers
7. Impeller of special alloy

1½" B-38L running dry on construction job

3" B-80L under water level on river job

6"-8" B-150/200L on power house dam project

FLYGT Corporation HOOSICK FALLS, N. Y.

Visit FLYGT at the AMC Mining Show Booth 1016

WESTERN SALES & SERVICE: STANCO MFGS. & SALES INC., 1666 Ninth St. (CORNER OF OLYMPIC) SANTA MONICA CALIF.

PUMP BETTER ELECTRICALLY — USE FLYGT!

Versatile electronic relays provide positive **REMOTE LEVEL CONTROL** *for water works and disposal plants*

B|W

Electronic Liquid Level

CONTROLS

Now—two new performance-proved electronic relays that provide accurate, reliable, floatless means of controlling any conductive liquid or moist bulk material having a resistivity of up to 12.5 megohms!

☐ Outstanding features and characteristics include: Positive means of adjusting sensitivity for specific applications. Very low electrode potential and low electrode current. No shock or sparking hazards. No product contamination due to electrolysis. Quick and easy conversion for direct or inverse operation. And, because both relays will operate several miles away from the level sensing electrodes, they permit accurate control of liquids from remote locations.

Other reliable B/W Floatless Liquid Level Control Equipment

Induction Type Relays

Automatic Alternators

Signals and Alarms

Electrodes and Holders

Complete technical data available upon request—write today!

THE B|W CONTROLLER CORPORATION

2290 E. MAPLE ROAD • BIRMINGHAM, MICHIGAN

Manufacturers of Liquid Level and Industrial Motor Controls

Flood Flows in Alabama

(*Continued from page* 197)

may not represent the maximum discharges from the respective drainage areas. In general, the data agree quite well though it would normally be expected that the smaller areas would contribute a greater unit of area flow than would the larger ones. Actually, within the rather narrow limits of area used, the larger watersheds show a slightly larger flow per square mile —23.4 cfm/sm for the 150 to 300-sq. mile areas, to 20.8 for the 100 to 150-sq. mile areas, and 19.6 cfm/sm for areas of less than 100 sq. miles.

For purposes of comparison, similar records on the three large rivers of Alabama show a discharge of 7 cfs/sm for the Mobile; 8.4 cfs/sm for the Tombigbee; and 7.25 cfs/sm for the Alabama River. These have drainage areas, respectively, of 43,000, 15,500 and 20,700 sq. mi. at the points these measurements were made.

The base period on which the study was made and report issued was the climatic years 1939-1955. The climatic year covers the period April 1 to March 31. The "Streamflow records during this period provide reasonably good a real coverage and, in addition, yield index values that differ but little from those that would be obtained by using the longest period of record available."

The average annual rainfall for Alabama is about 53 inches; but, as is generally the case, there are variations, with the heaviest rainfall in the southwest portion of the State.

Sanitary Engineer Salesman

A man with sound and successful experience in the sale of water and waste equipment is available. He has sold equipment to industries, municipalities, contractors, architects and engineers. He has had broad experience over the past 20 years in sales and sales management. He holds an engineering degree and is a licensed professional engineer. Write Box 10-3F Public Works, 200 South Broad St., Ridgewood, N. J.

Sanitary Engineers for the Public Health Service

Competitive examinations for appointment of sanitary engineers as regular officers of the Public Health Service will be held in late January. For more information write The Surgeon General, Public Health Service (P), Washington 25, D. C.

CLASSIFIED

SALES REPRESENTATIVE

Large established grey-iron producer in the water works field desires additional sales personnel. Must be willing to travel. Engineering and/or college background desirable. Good opportunities for advancement. All replies confidential. Send complete resume and photograph to:

Box 9-I

Public Works Magazine
200 South Broad Street
Ridgewood, New Jersey

WATER MANAGER

City of 12,000 requires a water manager who should be a graduate engineer with at least three years experience including one in utility management. Appropriate experience may be acceptable in lieu of college degree. Water system includes wells, pumping stations, tanks, and distribution mains. Salary commensurate with ability and experience to $7,200 maximum plus benefits.

Write to:
Director of Public Works
Cambridge, Maryland

Superintendent of Streets

Graduation from a standard high school or trade school, and preferably supplemented with courses or experience in civil engineering, and extensive experience in public works construction and maintenance. Salary range $6,786 to $8,034, dependent upon qualifications.

Write to:
Personnel Director
City Hall
City of East Providence, R.I.

Sales Mgmt. Executive For Pacific Northwest

Age 45, strong educational and experience background in Water, Gas and Sewage fields, involving both Municipal and Industrial selling. Desires area sales supervisory position in the Pacific Northwest. Excellent references including the Editor of Public Works. Request for further information will result in prompt detailed personal response. *Write to:*

Box 10-2
Public Works Magazine
200 South Broad Street
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CIVIL ENGINEER

(Sanitary Engineering)

For positions in Los Angeles County Flood Control District. Must have one year's experience in sanitary engineering and at time of appointment, a Calif. State Certificate of Registration as a Civil Engineer. Salary $889 month. Work involves water conservation, underground water supplies sea water intrusion, sewage reclamation, etc. *Apply to:* Mr. Pronk Flood Control District 2250 Alcazar St., Los Angeles 33, California

Courtesy Morse Boulger Inc.

● **MUNICIPAL incinerator of Town of Hempstead, Long Island, N. Y., which utilizes waste heat to produce steam for power.**

BETTER MAINTENANCE FOR WASTE-HEAT BOILERS AT INCINERATOR

FREDERICK W. TRAUTWEIN
Superintendent,
Department of Sanitation,
Town of Hempstead, New York

ENGINEERS at the Town of Hempstead Incinerator in Merrick, Long Island, have successfully solved a problem of maintenance and performance of soot blowers in two Erie City three-drum waste-heat boilers which utilize heat generated by the incinerator to produce steam. The soot blowers originally installed at the first bank of tubes were replaced with long retractable soot blowers. After 20 months of operation, savings in element replacement have repaid about 20 percent of the installation cost.

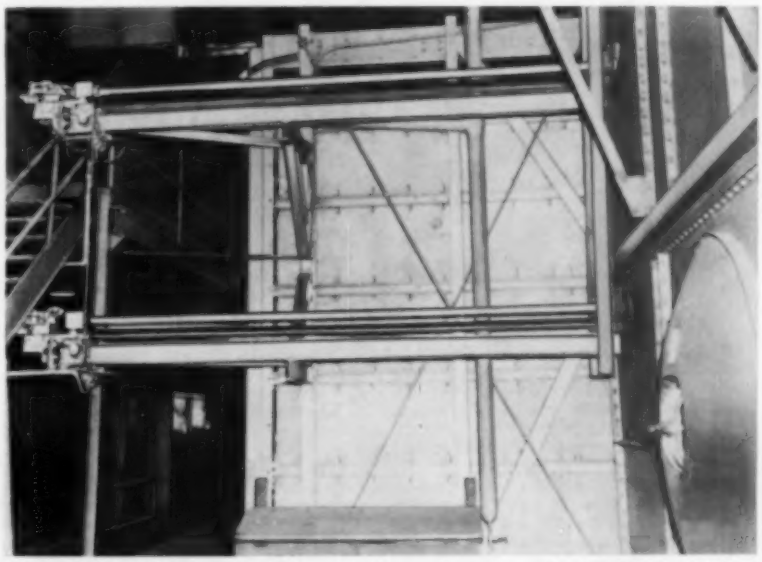
Constant exposure to the high temperature—at times 2000°F or more—of the flue gases from the refuse being incinerated reduced the average life of the original soot blowers in the two boilers to six months. In addition, the heavy, varied and extremely adhesive deposits on the boiler tubes were not being removed effectively. Boilers had to be shut down frequently to permit supplementary hand lancing of the heating surfaces.

Each of the two boilers has a design capacity of 58,000 pounds of steam per hour at 275 psig saturated. Both are operated at 215 psig with loads fluctuating constantly and rapidly over a range of 20,000 to 45,000 pounds per hour. Maximum load has been 73,000 pounds per hour, and the minimum has been 7,000 pounds per hour.

Solution of the problem was found in installation of long retractable soot blowers. These are air-driven Vulcan Model T-3 made by Blaw-Knox Company, Copes-Vulcan Division, Erie, Pa. Individual push-button controls with this equipment reduce soot blowing procedure to the opening of two valves to admit power air and blowing steam, pushing a button to start automatic operation, and closing two valves when the cleaning cycle is completed.

In addition to the better cleaning, substantial savings in maintenance costs are being realized. The complete installation will repay its cost in less than three years. After 20 months of operation, blowing twice daily, savings in element replacements have repaid about 20 percent of the installation cost. Additional savings that have resulted from elimination of shut-downs and hand lancing indicate a quick return on the investment. No maintenance problems have been encountered, and the lances show no signs of deterioration.

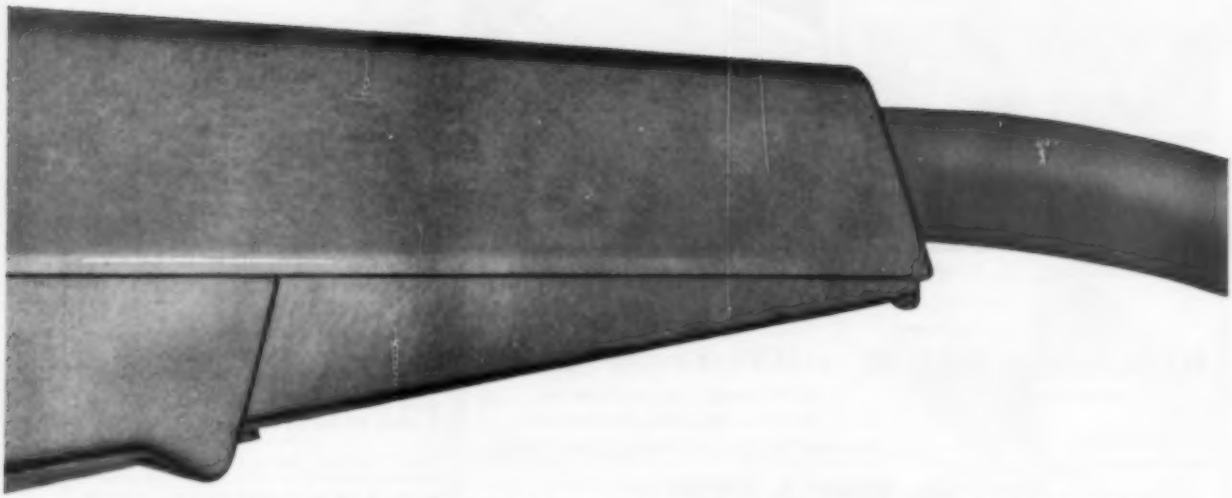
The governing body of the Town of Hempstead is the Town Board, of which Presiding Supervisor Edward P. Larkin is the head. Engineers for the Town of Hempstead were Nussbaumer, Clarke and Velzy of New York and Buffalo.



● **AIR-DRIVEN long retractible soot blowers have been installed in waste-heat boilers. Savings to date indicate that installation cost will be repaid quickly.**

New from Westinghouse

high intensity
OV-50 mercury
luminaire
distributes more
light over
wide roadways

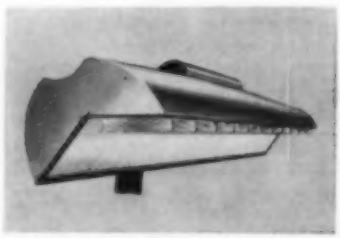


You need high-level lighting where traffic is heavier and faster and roadways are wider. Here's why the new Westinghouse OV-50 mercury luminaire is your best bet.

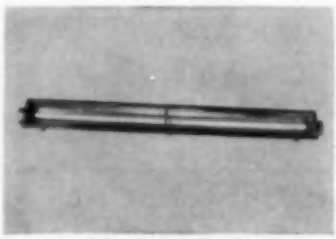
This good-looking unit, with external ballast, takes 700- and 1000-watt mercury lamps, clear or color improved. Boosting illumination intensities can be just a matter of changing lamps. And you get more light because a scientifically designed optical system directs a major portion of this extra light to the roadway surface where it is needed most.

Maintenance is minimized, too. With the new OV-50, the optical system is completely sealed—no dust, moisture or bugs can get inside. The die-cast aluminum housing has an attractive "hammer-tone" silver aluminum, baked enamel finish that's highly resistant to heat, abrasion and corrosion. The OV-50 fits standard poles and brackets, or davit poles with a minimum 7½-inch pipe tenion. Find out more about the OV-50 with either internal or external ballast. Contact your nearby Westinghouse representative or write Westinghouse Lighting Division, Edgewater Park, Cleveland, Ohio. Remember—you can be sure . . . if it's Westinghouse. J-04478

Westinghouse



NEW WESTINGHOUSE FAN-COOLED, FOUR-LAMP "MAINSTREETER" gives you the benefits, prestige of fluorescent roadway lighting . . . economically. Designed to be located at the curb and mounted parallel to it, the trim "Mainstreeter" keeps dangerous glare out of drivers' eyes. Four fluorescent lamps, coupled with special reflector and refractor, mean more light more uniformly distributed (coefficient of utilization is often as much as 50% higher). A cooling system is thermostatically controlled to provide lamp cooling when needed.



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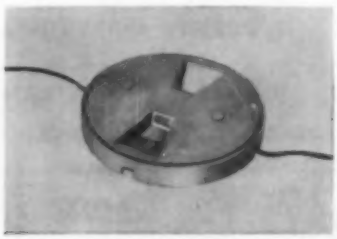

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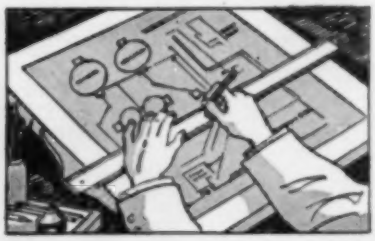

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(*Continued from page 205*)

substantial disruption in the owner's program, so careful preparation and adherence to a work schedule is of importance.

Many other items in the General Clauses & Convenants section, in addition to the previously mentioned Changes vs. Additions & Deletions, are worthy of serious consideration. For example the contractual requirement for the establishment of a local office by the consultant, staffed with competent personnel, often is of advantage in the reduction of fees for special appearances and conferences; and the precise indication of what constitutes an "acceptance" by the owner, following his review of a submission, is critical to the connotation of a change which merits an additional fee payment.

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Each of the remaining technical sections of a typical specification format usually can be divided into six general sub-sections, as follows: 1) General purpose, requirements and objectives; 2) existing information and data; 3) preparation of new information and data; 4) assembly, evaluation and presentation of work; 5) owner's obligations; and 6) fee payment procedures. Ohio Specifications condense each successive section through the elimination of repetitious requirements. For example, any detailed design report of final construction plans necessarily must be initiated and include appropriate consideration to the owner's wishes as indicated by his acceptance of the preliminary engineering studies or report. Consequently it is desirable to include an obligation clause, in successive sections, which requires the consultant to refine and develop existing information and data to current status, to comply with the requirements of the previous section; and to secure appropriate current written approval, by the owner, of the criteria and procedures proposed for the next stage.

This contractual requirement is of great advantage to all parties to the engineering agreement, or contract, in that the work is not predicated or advanced upon incorrect assumptions. Such unpleasant conditions might embarrass either party financially and penalize the scheduled progress of the work.

Of course there are many equally important concepts which should receive study in the separate technical sections of any specifications, but one more example is especially worthy of mention. This involves the question of what type and

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amount of fee schedule is proper under various conditions.

The opponents to a cost-plus condition point out that the more a consultant spends, the more he earns; others say that any design fee, related to an estimated or actual project cost, invites over-design or tends to minimize the application of ingenuity to cost reduction. Obviously the value of any curve or graph relating to a proper fee percentage, is warped by the cost of a project which is over or under-designed. Fixed fees or lump sums may or may not be proper either.

So the format principle of isolating, categorizing and referencing the work elements pays the extra dividend of being able to apply different types and amounts of fee schedules to different phases of the work. Specifications of this type also permit the owner to keep related parts of a large program in proper balance, for fiscal or other reasons. For instance, the final design and construction plans for an immediate project may require at least preliminary engineering consideration on a related project which must be delayed until some future time. It is very convenient to have one set of specifications which extends complete flexibility to the advancement of each project only to the degree necessary or desirable at the time. For example, the advance purchase of right-of-way or property may save the owner a substantial amount of money; but the precise takings, which will be necessary to accommodate the project, undoubtedly will require some degree of preliminary or design engineering.

Specification Appendages

Appendages to a set of specifications, although they are not necessarily included as a part of the contract, may contain various typical forms and sample sheets for guidance and assistance to the consultant in the contemplation or performance of the work which he solicited or accepted from the owner.

Ohio's three-page double-spaced Sample Form of Engineering Agreement, is evidence of how short and simple a contract form can become when adequate specification references are available for concise incorporation or deletion in a brief clause of the agreement. The only other agreement pages normally necessary identify the participants; describe the type and limits of the project; establish a time schedule; incorporate required code references to the specifications; and provide an appropriate signature area.

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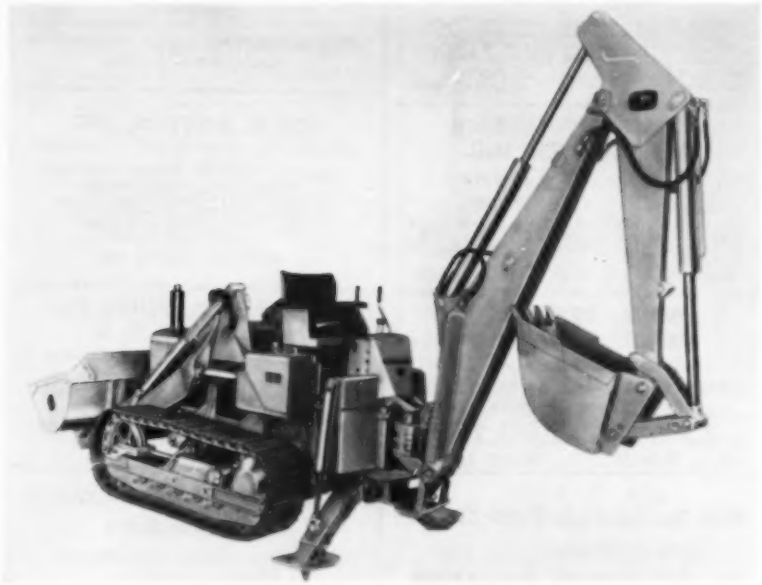


Industrial Tractors

A complete line of tractors and equipment developed for the earthmoving, logging, landscaping and material handling field will comprise the largest selection and include the largest power sizes ever offered by the Company.

Two crawler tractor series will be manufactured—in 40 and 50 engine hp sizes. Wheel tractors will include four models of 40, 50, 60, and 85 engine hp.

All the tractors will have power-matched equipment and will feature built variable-speed engines. The 4-and 6-cylinder valve-in-head engines will operate at speeds up to 2500 rpm providing the advantage of constant efficiency throughout the full throttle range. Gasoline or Diesel options will be offered throughout the line.

Equipment for this series includes backhoes, loaders, bulldozers, mowers and specialized tools such as a telephone cable plow. In addition, sixteen units in the larger power sizes are scheduled for later production.

Hydraulic controls to increase work output and work quality through simplified earthmoving equipment operation are included on the line. On the crawler-loader units, a single lever controls all movements of both the loader lift arms and the bucket. On both crawlers, a T-bar control for all-hydraulic bulldozers will command all four operating functions—angle, tilt, lift, and cut. The control lever is engineered so that the operator virtually "holds the blade in his hand" with the blade repeating the position in which the T-bar is held.

Deere & Company, Moline, Illinois.

Circle **No. 10-1** on the convenient reply card facing page 34.

Tail Gate Control

Dump truck operators may now operate tail gate locks from driver cab under vacuum control with a Vacuum Tail Gate Control No. 11R-1. The vacuum unit is especially designed for simple attachment to dump trucks with hydraulic brakes. Particularly useful where gravel and other materials must be dumped in accurately measured quantity, the control permits opening the tail gate gradually as required by load weight, truck body angle, and moving speed.

Easily installed to hydraulic system and truck body, the control kit includes a 4-way metering hand valve which may be attached to steering post or dashboard, a double-acting push-and-pull vacuum power cylinder together with all necessary couplings, nipples, elbows, clamps.

Velvac, Inc., 3534 W. Pierce St., Milwaukee 3, Wis.

Circle **No. 10-2** on the convenient reply card facing page 34.

Motor-Generator

This series of combination electric motor and 60-cycle AC generator sets are designed to be used in pairs and to provide a continuous source of 60-cycle AC current. Output is 10KVA and speed is 1760 RPM. In case of power line failure, the generator is driven by a gasoline or diesel engine which is automatically brought up to proper speed so that the frequency dip will not exceed approximately five or six cycles. To minimize dip in frequency and voltage when normal power fails, the motor generator is carried by the momentum of a massive fly wheel and either a gasoline or diesel engine may be used as prime mover. The generators are powered with either single phase or 3-phase induction low-slip motors, length 3′ 11″; width 17″; height 18; weight 698 pounds net.

Kato Engineering Co., Mankato, Minn.

Circle **No. 10-3** on the convenient reply card facing page 34.

Provides continuous source of power.

Pump-Screen

The completely automatic pump-screen is suited for small and medium size "package" plants, as it is practically care-free. There is no need to worry about a power failure as the flow will continue through the bar screen which is an integral part of the system. For very small plants, the bar screen alone may be sufficient.

Flow entering the aeration tank is instantaneously mixed with the raw sludge and return sludge. The self-adjusting orifices of the American "Aircomb" eliminate all danger of clogging.

The American Well Works, Aurora, Illinois.

Circle **No. 10-4** on the convenient reply card facing page 34.

Aluminum Culvert

An aluminum product for use by the culvert manufacturing industry, the Kaiser aluminum culvert sheet, has undergone extensive testing and research. Installations in the field indicate the suitability of aluminum for applications in most soil types, and show that it satisfactorily withstands the loadings to which culverts are subjected. The aluminum culvert sheet is one-third the weight of its steel counterpart and 1/35th the weight of concrete. Aluminum culverts have been placed in the basic soil types found throughout

the United States; some 40 field sites also supply load data. Aluminum culverts may be coated. The finished culverts may be cut with conventional hand and power saws.

Kaiser Aluminum & Chemical Corporation, 300 Lakeside Drive, Oakland 12, California.

Circle **No. 10-5** on the convenient reply card facing page 34.

Aerial Lift

A line of aerial lifts designed for a wide variety of utility, municipal and industrial overhead operations, the Servi-Lift units require no outriggers and may be mounted on vehicles as small as 1-ton trucks. Two standard models are available, one with 36-ft. working height, the other with 40-ft. working height. Both models are canopy mounted on an "H" frame which leaves deck and compartment space clear and permits mounting with minimum modifications on any standard or existing body. The entire structure, which includes crow's nest, upper boom, lower boom, and turret arm, is built of fibreglass for exceptional strength and maximum insulation. Primary power source is a standard commercial electric generator driven by auxiliary motor or by the truck engine.

Continuous 360° horizontal rotation of the entire unit with no stopping point, lower boom travel from horizontal to vertical, and 270° rotation of the upper boom provide operating flexibility and coverage of a wide working area. One hand, push button type operating controls governing both direction and speed of all movements, are located in the crow's nest and at truck level. All control and power systems are fail-safe. Both booms, and rotation of the unit can be actuated manually if necessary. For operations where high voltages are involved, a high dielectric (50 KV) crow's nest and insulated operating controls are available.

An additional 10 feet of working height may be obtained by mounting any unit on an elevator base assembly. A winch and derrick attachment is available for use in setting utility poles.

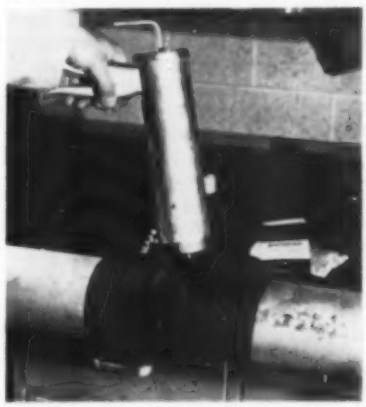
Hunt-Pierce Corporation, 59 Meadow Street, Milford, Connecticut.

Circle **No. 10-6** on the convenient reply card facing page 34.

Pipe Patch

A method of pipe repair, offering the advantages of thermosetting epoxy resins, the system can be used on any diameter pipe operating at pressures up to 100 psi. The method requires a minimum inventory of materials for repairs on all sizes of pipe. The average workman can repair a small hole in a six-in. pipe in 10 to 30 min., depending on working conditions and amount of experience. The epoxy used is "Scotchcast" brand electrical resin No. 4. This resin is not affected by gasoline, fuel oil, crude oil or other hydrocarbons, and it resists most chemicals. Practical operating temperatures of the resin are limited by extremes of pressure and by increased corrosive action at higher temperatures. However, the epoxy, itself, will withstand continuous operating temperatures in excess of 200 degrees F.

Using application techniques developed in electrical cable splicing, the repair system utilizes resin pressure method. A pressure hand gun is used to force the epoxy fluid into a simple tape mold, through a



specially designed injection fitting.

The resin hardens in 30 min. and is completely cured in less than 2 hours. Backfilling, following field repairs, can be started 10 min. after the patch is completed.

Minnesota Mining and Manufacturing Co., 900 Bush Avenue, St. Paul 6, Minn.

Circle **No. 10-7** on the convenient reply card facing page 34.

Builder's Level

A builder's level—the GKO E—designed for American use by surveyors, engineers, contractors and municipalities, is highly compact and portable, extremely rugged, and so simple in design as hardly ever to require adjustment. All operations are from behind the instrument: The telescope level and bullseye level can be observed simultaneously, from the eyepiece end. The horizontal circle reading magnifier is placed underneath the bullseye level, so that the operator can view both levels, read the circle, and look through the telescope by a very slight movement of his head, but without otherwise shifting his position. For finer adjustments a horizontal slow-motion screw has been added. In addition, the tilting

screw has been moved to the eyepiece end of the telescope, making it more convenient for the operator. The eyepiece adjustment is threaded and equipped with a diopter scale, and the focusing drive is of the rack-and-pinion type.

Kern Instruments, Inc., 120 Grand St., White Plains, N. Y.

Circle **No. 10-8** on the convenient reply card facing page 34.

Infrared Detector

An infrared traffic detector designed for in-minutes installation and easy mobility from one location to another to cope with changing traffic patterns, called the Traffitrol Detector, offers wide flexibility to traffic engineers and law enforcement officials in studying and controlling traffic. It can be connected with all types of existing traffic control boxes and central computers to actuate semaphores in accordance with traffic flow. The use of infrared techniques makes the device highly accurate, virtually foolproof, and able to detect and count cars traveling up to 80 mph.

Measuring only 8½ by 8½ by 9 in. and weighing 18 lbs, the detector can be installed without excavating pavement. The detector can be mounted on utility poles, sides of buildings or other locations up to 50 feet from the roadway. It is positioned so that an infrared beam projects downward onto the traffic lane or lanes. The beam is reflected from the pavement back into a receiver lens. When vehicles break the beam, they are detected and counted.

A single lane of traffic can be monitored or the detector can be positioned to regulate traffic lights on a multi-lane street. Should existing traffic patterns change, the detector can be removed easily and placed elsewhere. This wide versatility in mounting, makes the detector especially useful for controlling vehicles through detours, during traffic tests or in other temporary situations.

Minneapolis - Honeywell, Heiland Division, 5200 East Evans Avenue, Denver 22, Colorado.

Circle **No. 10-9** on the convenient reply card facing page 34.

Space Heater

An indirect fired "vented" portable space heater, Champion's Model 120—Vented, features fume-free, odor-free operation. Designed especially for use in confined areas where fumes are objectionable, the unit circulates 1,885 cfm of heated fresh air. It has a 15 hour continuous burning capacity, fuel filter, high heat cut-off switch and automatic purging.

Champion Mfg. Co., 3700 Forest Park Ave., St. Louis 8, Mo.

Circle **No. 10-10** on the convenient reply card facing page 34.

Tractor Shovel

A 107-hp diesel engine, a range of bucket sizes and three attachments are now available as optional equipment for Michigan Model 85A tractor shovels. Equipped with a 1¾-yd. standard excavating bucket, the shovel has a 9000-pound lifting capacity, with standard counterweight and non-ballasted tires. In addition to the standard excavating bucket, optional buckets ranging in capacity from 1 to 2½ yds. are available. Versatility of the unit can be increased by attachments: A rotary snow plow capable of handling up to 1200 tons of snow per hour; a street sweeper that can be mounted in place of the bucket; and an hydraulic snap-mount backhoe that can be attached to the rear of the machine in less than a minute without the use of tools or mechanical assistance.

Construction Machinery Division, Clark Equipment Company, Pipestone Plant, Benton Harbor, Mich.

Circle **No. 10-11** on the convenient reply card facing page 34.

Motor Grader

Combination of manual and hydraulic steering is optional.

The Model 502 motor grader offers an exclusive combination of planetary axles, four wheel drive, four wheel steer, four wheel brakes, power shift transmission and torque converter.

The power shift transmission gives four forward speeds up to 19.1 mph, and four reverse speeds up to 23.5 mph. The combination of the torque converter and planetary axle reduction at the wheel hubs helps to absorb shocks and eliminates axle breakage. Four independent 16 in. by 4 in. face hydraulic brakes and a separate parking brake are standard equipment.

Standard equipment also includes: Full hydraulic steering; hydraulic sideshift moldboard; 106 hp GMD 3-71 Diesel engine; and 14:00 x 24 —10 ply tires.

Pettibone Mulliken Corporation, Pettibone New York Division, 1212 E. Dominick St., Rome, New York.

Circle **No. 10-12** on the convenient reply card facing page 34.

Flasher Light

A lens capable of withstanding the heaviest blows from a hammer or other rough treatment during construction jobs has been developed for use in Selecto-Lite safety flasher lights. Installed in an all virgin plastic frame, the 7-inch red or amber lens contains an inhibitor to prevent discoloration or crazing. The frame allows for 360° visibility. Lights are powered by transistorized power paks with or without push button control of flash duration. A 6 volt, 8 cell battery and G. E. bulb are used with the standard units.

Selecto-Flash, Inc., East Orange, N. J.

Circle **No. 10-13** on the convenient reply card facing page 34.

Refuse Body

A movable bulkhead maintains uniform compaction of loads.

The "push button" controlled refuse collection truck body, the Colectomatic Mark II, automatically loads garbage and trash, and speeds up the collection of refuse wherever used. The body has an unusual compressing action which compacts the collected trash to high density, serving more homes and businesses on each trip of the refuse collection vehicle. These units are used by city garbage and trash collection departments, as well as by private contract refuse collectors or scavengers in large cities and small towns throughout the country.

The unusual features of the Heil design provide for push button control of the hydraulic powered mechanisms. Refuse can be loaded and compacted merely by fingertip pressure on a push button, after placing the material in a receiving hopper at the rear of the truck.

The unit can also be equipped with a special device which tips large 21 bushel refuse hoppers, automatically emptying their contents into the receiving hopper then returning the wheeled hoppers to the ground for further service as trash receptacles. Spotting these wheeled trash hoppers at convenient locations is an economical and convenient method of maintaining sanitation and cleanliness throughout industrial areas, large housing projects, supermarkets and other retail operations. The body is sealed to prevent spilling or dripping of objectionable liquids when collecting raw garbage or other liquid refuse.

The Heil Co., Milwaukee 1, Wisconsin.

Circle **No. 10-14** on the convenient reply card facing page 34.

Trash Pump

The Foundation Sewage-master is designed and engineered specifically for municipal and construction work where raw sewage and liquids containing large solids or stringy material must be handled without interruption.

The impeller is the enclosed non-clog type. It will pass 4-in. solids. Rags, rope and other fibrous materials pass through the pump without winding around the impeller. The discharge valve is designed without cage or rods, thus preventing any build-up of solids in the valve body.

A separate high-capacity vacuum pump and quick-acting air-separation tank mechanism insure a positive head on the suction side of the pump at all times, thus guaranteeing uninterrupted sewage pumping. Suction and discharge connections are plain end for easy hook-up to pipe or hose nipples.

The Sewage-master 4 is equipped with a Hercules, 3-cylinder diesel unit and is powered to permit 24-hour-a-day continuous pumping without breakdown. The unit is mounted on roller-bearing pneumatic tires and comes with tow bar for easy movement to the job site.

Foundation Wellpoint Corporation, Long Island City, New York.

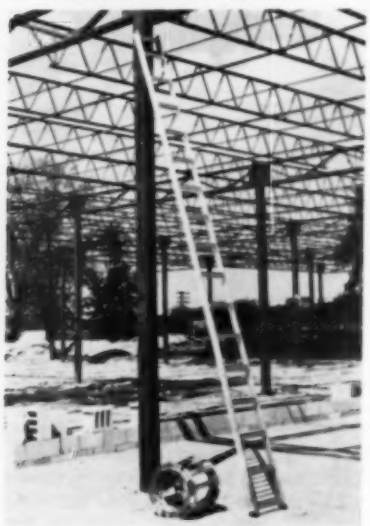
Circle **No. 10-15** on the convenient reply card facing page 34.

Roll-Up Ladder

The straight ladder has undergone a basic change in design with this patented aluminum ladder manufactured in 12-ft. and 16-ft. lengths. Ladder rolls up into a compact bundle so it can be carried like a suitcase or transported in the trunk of a car. When unrolled and locked into position, it becomes rigid and handles like any conventional straight ladder. It will easily support a load of 1,000 lbs. in the ladder position. Can be unrolled and locked in less than 30 seconds, and rolled up again just as fast. Easily stored on a shelf or in any small space, the 16-foot size rolls up into a 20″ diameter bundle which weighs approximately 24 lbs.

Aladdin's Product, Inc., 50 West Broad Street, Columbus 15, Ohio.

Circle **No. 10-16** on the convenient reply card facing page 34.



Two-way Radio

This portable, two-way radio can be recharged by using a car's cigarette lighter or an electrical outlet. Key to the re-charging is a built-in battery charger used with a 12-volt d.c. vehicular system or 117-volt a.c. A rechargeable nickel cadmium power supply enables constant charging on a shelf while awaiting use. The equipment may be charged thousands of times without battery damage. The unit contains an all-transistorized receiver, and can be operated in the 25-54 mc. and 144-174 mc. frequencies, which means it may be used to transmit to existing vehicular two-way radios, to pocket units, or portable-to portable. The equipment can be used for two days without any battery charging at all. For applications where no outlet is available, the unit may be obtained with a seven-day dry pack.

Section P., General Electric Communication Products Department, P. O. Box 4197, Lynchburg, Va.

Circle **No. 10-17** on the convenient reply card facing page 34.

Lifting Tailgate

A flat bed dump with a lifting tailgate mounted on the curb side, the elevating gate, known as the Watson Hide-A-Gate, folds up underneath the body when not in use, permitting access to the body for hand loading of lighter parcels. The gate has 1200 lbs. capacity, is electric-hydraulic, and can operate independently from the PTO driven dump body. Because of its construction, the Hide-A-Gate is adaptable to most truck side mounting problems, whether the body be a dump type or stationarily mounted to the truck frame.

H. S. Watson Co., 1316 67th Street, Emeryville 8, Calif.

Circle **No. 10-18** on the convenient reply card facing page 34.

Curb Machine

Bituminous concrete curbing for driveways, parking lots or any other paved area can be laid with this bituminous curb machine. Bituminous material is loaded into the hopper of the machine and carried by a screw conveyor into a mold chamber where it is compressed and shaped to any contour desired—to 6″ max. height and 8½″ max. width. The machine will lay up to 4 ft. of curb per minute and can be used to lay curb to within 1 inch of any obstruction. Model 60 weighs 340 pounds; overall dimensions are 32″ and 63½″ long and 19″ wide, including handle.

F & H Products Company, 1531 Washington Ave., Piqua, Ohio.

Circle **No. 10-19** on the convenient reply card facing page 34.

Traffic Control

This electronic detector system is operated from circuits embedded in the pavement to control traffic automatically or to count passing vehicles. Designed for use near busy intersections, the system can be used to operate signal lights in keeping with the changing flow of traffic and to record the passage and speed of vehicles.

The all-transistor RCA Ve-Det system employs a wire loop buried in the roadway surface. When a vehicle passes over this loop, a signal is received by the portable detector, a unit measuring only 4 by 5 by 7 in., which can be moved to any wire loop installation in a highway system. Two detectors can operate from the same dimensions as the detector itself. One detector will cover any selected road lane.

Mass detection across as many as eight lanes is possible by use of a special loop design. Two detectors operating from a common power supply unit provide separate coverage of two adjacent lanes.

The detector may be connected with a counting device, traffic signal controller, traffic warning light, turnpike toll booth indicator, or to an automatic garage door opener. Because the wire loop is buried in the roadway, dependable operation of a traffic signal, for example, is assured under all weather conditions. The detector is effective in keeping tabs on vehicles operated at speeds ranging from two to 200 mph. As a traffic counter, the Ve-Det notes vehicles rather than the number of axles passing by, improving the reliability of the count.

Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.

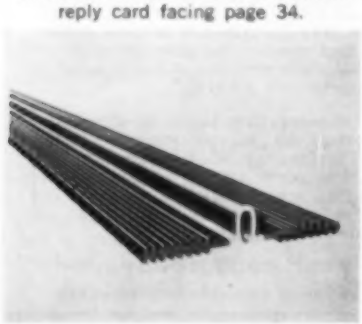
Circle **No. 10-20** on the convenient reply card facing page 34.

Waterstop

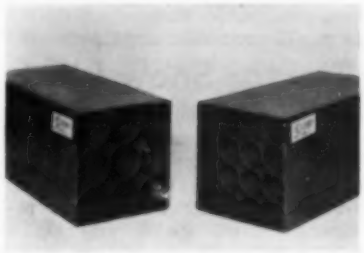
Sealtight Duo-Pvc Waterstops are extruded simultaneously from two Pvc compounds. The Pvc in the center area is compounded to combine strength with maximum flexibility, whereas, the multiple-rib area is extruded from the Pvc compound that offers strength with a desirable rigidity. Waterstops are designed to handle expansion without stretching the material or stressing the multiple-rib area. This is accomplished with the use of a U-bulb center area design that will mechanically expand up to 1½ in. or more. The opening to the U-bulb is protected by a thin membrane that prevents infiltration of concrete during pouring. This membrane is designed to tear under expansion and allow the U-bulb to accommodate expansion. The rib design provides holding power, strength and rigidity.

W. R. Meadows, Inc., 26 Kimball St., Elgin, Illinois.

Circle **No. 10-21** on the convenient reply card facing page 34.



Multiroll Files



Two Multiroll files, 9 tube and 16-tube models, offer a method for filing large drawings such as plat or project plans. The 9-tube model consists of 9 individual tubes with 4⅛″ diameter; the 16-tube model consists of 16 individual tubes with 3⅛″ diameter. Rear openings are closed to prevent air circulation. Tubes are encased in reinforced corrugated board container and secured to produce an assembly of surprising strength. Both the 9 and 16 tube models are available in 30″, 36″ and 42″ length. A visual index record form, furnished with each unit, permits material to be located at a glance. Files are finished in gray plastic-base enamel.

Roll and File Systems, Inc., P.O. Box 3863, Detroit 5, Michigan.

Circle **No. 10-22** on the convenient reply card facing page 34.

Riding Tractors

Two models of the Beaver Riding Tractor Model WT and Model WST; both have a 7 h.p. Wisconsin 4-cycle air-cooled engine and a floating pulley clutch.

The Model WT has a steering wheel, holding brake, a transmission with 3 forward and 3 reverse speeds; weight 595 lbs. The Model WST has a steering wheel, generator, battery and electric starter, similar transmission as Model WT; weight 665 lbs.

Both models have a length of 5'9″ and a 4'2″ wheel base. Overall width is 30″ at the widest point and 25″ at narrow point. Front tires are 4.00 x 8 in size, rear tires are 6.00 x 12 tractor grip type.

The full range of heavy duty engineered attachments include: a new rotary tiller "Cultmaster" with a 27″ width and a tilling depth of 6″, a cultivator, a side-type mower bar, triple gang mower which cuts a 60″ swath, a rotary 30″ mower, a 42″ snowplow and grader, a heavy duty 30″ special bulldozer blade, a 550 lb. roller, a lawn spiker, a scarifier for ground leveling, a moldboard plow and a heavy-duty dump trailer to haul wood, fill, fertilizer and other materials.

The Baird Machine Co., Stratford, Conn.

Circle **No. 10-23** on the convenient reply card facing page 34.

Tail Gate Spreader

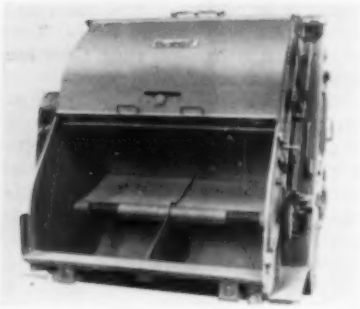
With the quick-disconnect device for the dual spinner tail gate type, Model "B" Hydro-Spreader, the spreader is fastened to each side of the dump body by means of two pins. No bolts, nuts or tools are required. The quick-disconnect pins makes it possible to mount or to remove the spreader in a matter of minutes without interfering with either the existing tail gate or the dump body.

For spreading salt the Model H-760 salt hood attachment is in a raised position allowing a variation of tail gate openings in accordance with the amount of salt being spread. This control of the amount of salt entering the spreader is in addition to the standard salt metering ports furnished on the spreaders. The salt hood also makes it possible to wash or flush out the spreader without dumping the salt from the dump body thereby reducing the time and cost.

Central Engineering Co., Inc., 4429 W. State St., Milwaukee 8, Wis.

Circle **No. 10-24** on the convenient reply card facing page 34.

Load-Packer



Gar Wood Industries, Wayne, Michigan.

Circle **No. 10-25** on the convenient reply card facing page 34.

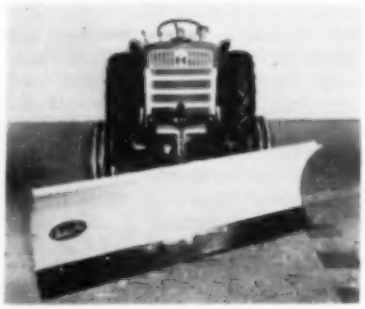
The Compartmented Load-Packer refuse collection body is designed for the loading of different materials in the same unit, hauling them completely separated, and dumping the load at different discharge points. After materials are loaded into the split-hopper the sweeper panel carries the materials into their respective compartments for compaction. When dumping, an individual retaining panel holds the load in one compartment while the other is discharged. The remaining load can then be dumped separately at a different discharge point.

Tractor Snow Plow

A seven-foot snow plow, which can be attached or detached in minutes, has been designed to operate on International 240, 340 and 460 tractors. The model features a reversible safety spring trip blade, with a hydraulic ram that connects quickly to the tractor's one valve Hydra-Touch controls.

Meyer Products, Inc., 18513 Euclid Ave., Cleveland 12, Ohio.

Circle **No. 10-26** on the convenient reply card facing page 34.



Tamping Roller

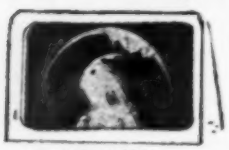
The Ferguson Model SP-120 self-propelled tamping roller is equipped with two 5' x 5' drums, wedge-type feet and powered with General Motors 4-71 125 hp diesel engine, Allison torque converter with final chain drive running in oil to the outer end of each drum. Empty, the roller exerts a bearing pressure of 372 psi; ballasted with water, the pressure is 550 psi.

The Allison 3-speed transmission and torque converter provides speed of approximately 2, 4 and 8 mph, both forward and reverse.

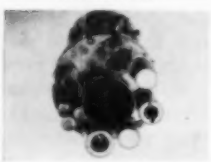
Shovel Supply Company, Dallas, Texas.

Circle **No. 10-27** on the convenient reply card facing page 34.

TELEVISION For Pipe Inspection



MONITOR



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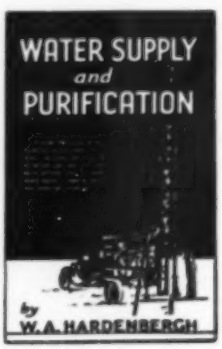

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Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintenance lines have been almost completely rewritten; the chapters on pipe conduits and on desinfection have been revised to bring the material in them up to date and a new chapter has been added on fluoridation.

Order your copy today

Limited number of copies available in Portuguese.

Fluorescent Lamp

The highly-efficient fluorescent lamp provides 15 percent more light than standard 40-watt cool-white lamps, and 36 percent more than daylight type lamps, as the result of a new phosphor combination. It produces 3200 lumens, compared to 2800 for ordinary 40-watt fluorescent lamps, and it has excellent light-maintenance characteristics.

The new high-efficiency white fluorescent lamp was designed solely for maximum efficiency. There are many potential applications for the new lamp in such places as warehouses, machine shops and garages. It is suitable for all uses where high light output at low cost is more important than critical color rendition.

Westinghouse Electric Corporation, Pittsburgh 30, Pennsylvania.

Circle **No. 10-28** on the convenient reply card facing page 34.

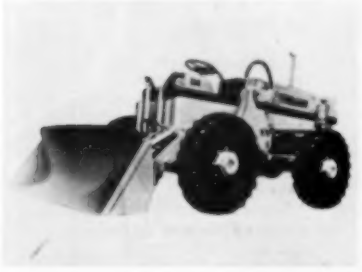
Tractor Shovel

With 6,500 lb. lifting capacity and bucket sizes from 1 to 1 2/3 cu. yds. the Trojan tractor shovel model 114 features power shift transmission, planetary axles, power steering and vacuum boosted hydraulic power brakes. Over 25 mph road speed permits fast, easy moves from one job to another.

Safety-curve lift arms give maximum protection to the operator while the wide tread and long wheelbase provides exceptional stability under the most difficult working conditions. A torque proportioning differential axle permits maximum utilization of power. Both gasoline and diesel operation is available through three engine options. A fully adjustable seat, lights and complete panel instrumentation are provided as standard equipment.

The Yale & Towne Manufacturing Company, Trojan Division, Batavia, New York.

Circle **No. 10-29** on the convenient reply card facing page 34.



Traxcavator

The third in a line of wheel Traxcavators, the 80 net hp. 922, 1¼ cu. yd. capacity bucket is powered by either a gasoline or diesel engine. A prime feature of the unit is the open and easily accessible operator's compartment and the location of all loader mechanism completely ahead of the operator's compartment. With a maximum lift capability of 12 ft. 2 in. and a dumping reach of 25¾ in., the 922 has a breakout force of 13,700 lbs. Turning radius at the outside rear tire is 20 ft. 4 in. Ground clearance is 14⅜ in.

Power train includes a two-speed power shift transmission, a torque converter, auxiliary transmission and a planetary final drive. Four wheel drive is used for working conditions and a two wheel drive is available for roading. A high-low speed range gives the unit four speeds forward and four in reverse.

Controls are positioned for ease of operation during all phases of the work cycle. The forward-reverse lever is mounted on the left of the steering column. The high-low speed selector and the two wheel-four wheel drive selector are both located to the left alongside the operator's seat. Bucket controls are to the right of the operator and a hydraulically actuated bucket positioner is standard.

The 922 has three brake controls. The left brake pedal acts to stop the machine and automatically shifts the transmission into neutral. The right pedal is not connected with the transmission, however, and serves only as a brake. A parking brake locks the transmission output shaft and automatically shifts the forward-reverse lever into neutral. Standard tire sizes are 12 ply 12:00 x 24.

Caterpillar Tractor Co., Peoria, Ill.

Circle **No. 10-30** on the convenient reply card facing page 34.

Plumb Bob

After being taken for granted for decades, the conventional plumb bob has come in for a complete revamping. The "Twin-Point Retracta-Bob" has many advantages over its predecessors. As the name implies, the point is retractable; that is, it is spring loaded to absorb impact shocks. The point, of hardened steel, is reversible and is usable at either end for quick replacement in the field. No tools are required to change the point. A tapered seat assures the point being centered.

C. L. Berger & Sons, Inc., 37 Williams Street, Boston 19, Mass.

Circle **No. 10-31** on the convenient reply card facing page 34.

Rotary Tiller

The Dearborn Tillit, driven by the tractor's power take off, engages the ground with rotating high strength tines which dig down to a maximum depth of six inches. The machine pulverizes and homogenizes the soil, burying top-covering, or thoroughly mixing any added aggregates. It is ideal for soil cementing operations; lawn renovation, including skinning off a weed covering and soil grub eradication.

Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

Circle **No. 10-32** on the convenient reply card facing page 34.

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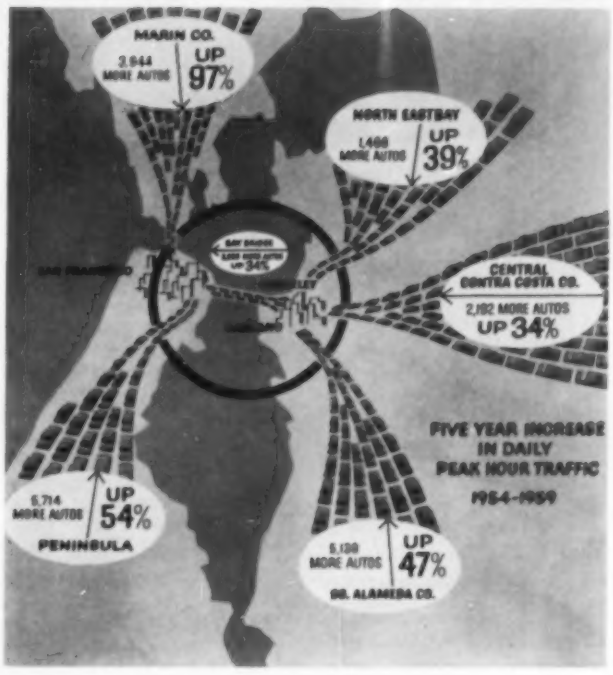
WORTH SEEING

Peak hour commuter traffic flowing into the central core cities in the San Francisco Bay area totals over 73,000 automobiles on a typical weekday morning between 6 and 9 a.m., according to a survey by the Bay Area Rapid Transit District made in 1959. Chart shows change in 5-year period from selected points in the area.



Crosswalk plow used by the New York City Department of Sanitation, which has 106 of these Minneapolis-Moline industrial tractors equipped with Good Roads plows.

Fish conservation by pumping saves salmon and steelhead fingerlings from the turbines of Brownlee Dam on Snake River. The young seaward-bound migrants are diverted by a barrier net, sorted, pumped half a mile through a flexible pipe made by Manhattan Rubber Division, then hauled downstream to safety in aerated and refrigerated trucks.

Dual purpose rink for winter ice skating and summer roller skating, located in Yonkers, N. Y., is covered with 30,000 sq. ft. of Alcoa corrugated aluminum roofing over a framework of laminated timber arches. Low gloss finish cuts the glare.

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WRITE FOR LAKESIDE SPIRAFLO BULLETIN 126

LAKESIDE
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222 West Adams St., Chicago 6, Illinois

by Arthur K. Akers

★ Rock salt for ice control will be marketed under the new name of "Safe-T-Salt" this fall by the Morton Salt Co.

★ **J. W. Arnold** becomes president and general manager, Parsons trenchers, and **J. C. Cox** sales manager for Shawnee products by the Parsons Co., Newton, Iowa, division of Koehring Co.

★ Add personal sorrows: Missing the Heil Company Colectomatic Mark II refuse body showing and luncheon in Central Park, New York, during the APWA Congress. Other editors had all the luck.

★ **Walden F. Wright** named assistant to **Bernard A. Noonan,** vice president - sales, Clinton Engines Corp.

★ **J. Wiley Perry, Jr.,** elected vice president and general sales manager of the Alabama Pipe Division of Woodward Iron Co., Anniston and Woodward, Ala. He succeeds our other old friend, **Stanley Bobbitt,** recently retired, now in consultant capacity.

★ **Alfred Dangler**, Jr. moves up from executive vice president and general manager to president of Hercules Galion, Products Galion, Ohio.

★ **David J. Byrd** appointed general manager of City Tank Corp., Corona, L. I. PUBLIC WORKS readers know City Tank as manufacturers of the Roto-Pac refuse collection units.

★ Willamette Iron and Steel Co., Portland, Oregon, assigns divisional status to its valve manufacturing operations, reports **Earl H. Atkinson,** sales manager, valve division.

★ Three major moves announced by Ford Motor Co., Tractor and Implement Division are: 1) expanded industrial sales organization; 2) adding Sherman Products Inc. equipment, recently acquired by Ford; 3) selling components and complete products to o.e.m. manufacturers.

★ **Roger G. Dittig, Jr.** added to field representation of the Cast Iron Pipe Research Association in technical advisory capacities. He has been director of sanitary engineering courses, Lehigh University. Bethlehem, Pa., will be his headquarters.

Mr. Dittig

Mr. Miller

★ **William F. (Bill) Miller** of Hy-Way Heat Systems Inc., elected by 17 bituminous equipment manufacturers as chairman of their B.E.M. Bureau, now sponsored by CIMA.

★ **FWD Corporation,** Clintonville, Wis., has appointed **H. G. Engel** market manager, highway maintenance field.

★ **John P. Kleber** will manage newly-set up Water and Chemical Sales Division, Hagan Chemicals and Controls Inc., Pittsburgh.

★ **Emerson S. Ellett** appointed deputy manager of Public Works, for Denver, Colo. Being a cousin of our own **Bill Smith** in San Francisco, we digress to mention him!

★ **R. Donald Brown** becomes executive vice president, Irving Subway Grating Co., New York.

★ **B. F. (Bud) Smith** upped to sales manager, Shunk Mfg. Co., Bucyrus, Ohio.

★ Allis-Chalmers Mfg. Co. organizes six construction machinery sales regions — Northwest, Western, Central, Eastern, Southern and Northeast — for closer relationships among customers, dealers and company.

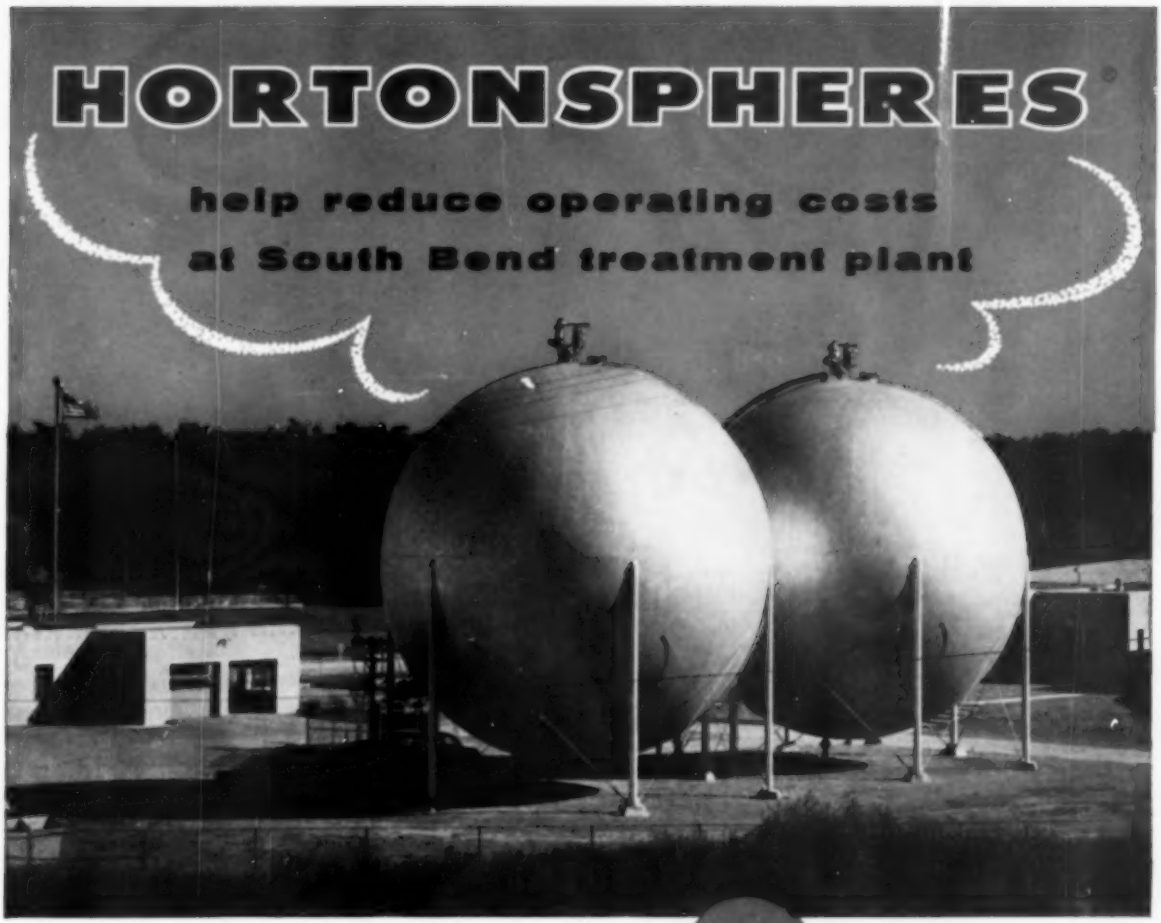
★ **Bert F. Whitbread** named sales manager of newly-organized construction equipment division, Minneapolis-Moline Co., Hopkins, Minn.

★ When two men in a business always agree, one is unnecessary.

—Dickey Data

HORTONSPHERES®

help reduce operating costs at South Bend treatment plant



South Bend, Indiana's sewage treatment system uses digester gas as low-cost fuel to drive sewage pumps and air compressors.

To equalize the variable gas production with demand, CB&I furnished these two 45 ft. diameter Hortonspheres®. Excess gas is stored in them at 40 lbs. per square inch working pressure—and released according to demand.

Hortonspheres are in demand *wherever* progressive operators seek to reduce sewage plant operating costs, for two reasons: Hortonspheres store *more* in *less* space; and, their performance is backed by seven decades of CB&I's craftsmanship in the design, fabrication and erection of steel plate structures.

Write your nearest CB&I office for details on Hortonspheres—for either digester gas or municipal gas service.

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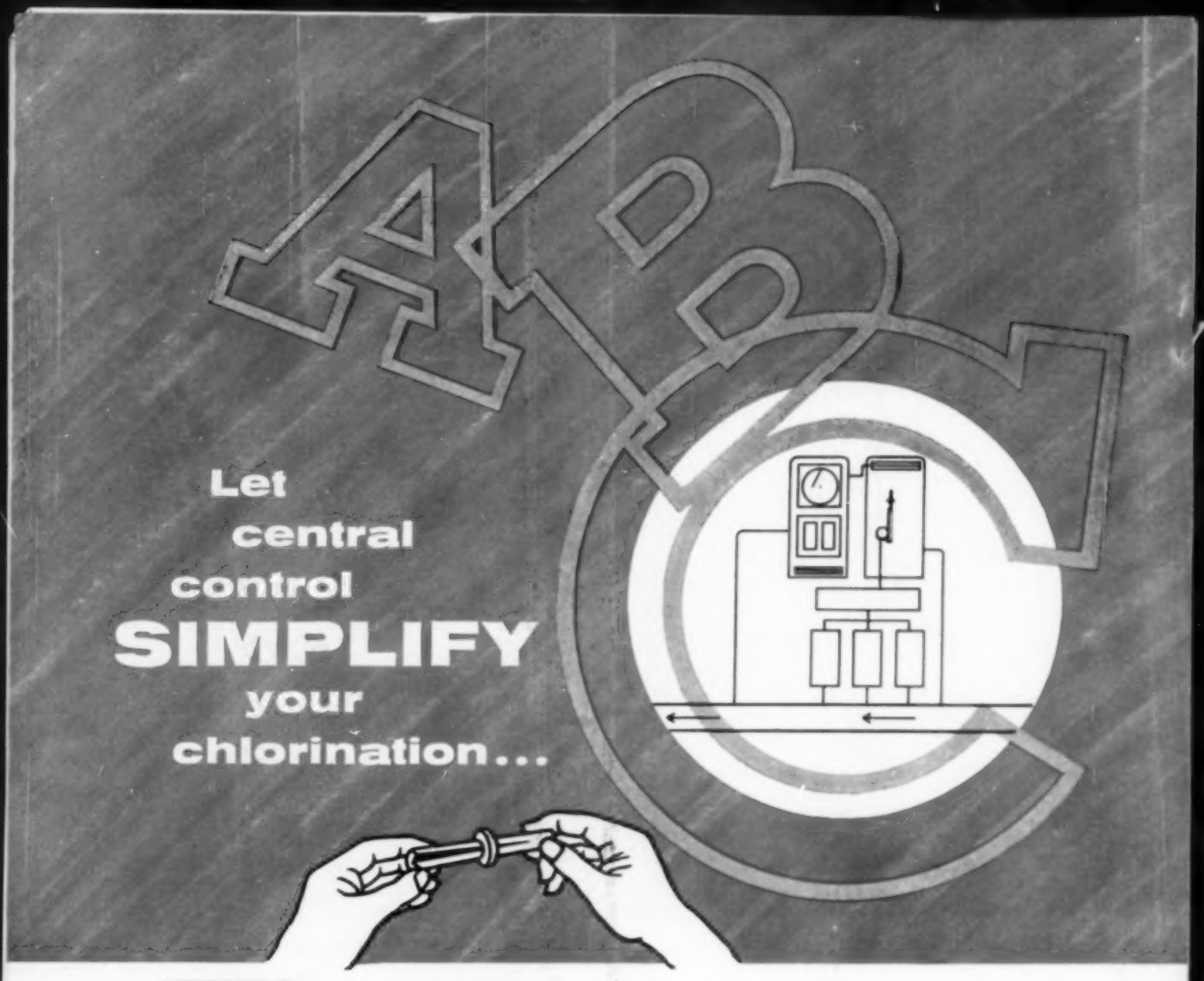

W&T **COMPOUND-LOOP CONTROL**

By residual analysis and information feedback, Wallace & Tiernan Compound-loop Control adjusts chlorinator feed rates to changing water flows and chlorine demands. You can add W&T Remote Residual Recording and Controlling Components throughout your water system and centralize control at any desired location. You select the desired residual on a central panel and the Compound-loop System maintains that residual faithfully.

Remote recording by W&T gives you duplicate residual records and minute-to-minute information where it helps guide operation. Remote controlling by W&T lets you adjust a chlorinator miles away. And W&T Remote Components adapt to almost any system, any type of control.

With remote residual recording and controlling by Wallace & Tiernan you centralize control... save time and operating expense... extend the advantages of the Compound-loop method.

For more information, write Dept. S-142.78

WALLACE & TIERNAN INCORPORATED

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